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LEIOMYOMA OF THE IRIS*

REPORT OF A CASE

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The subject of leiomyoma of the iris has been confined largely to the realm of academic conjecture, discussion, and controversy. Very few cases have been reported in the literature, and in most of these the pathologic diagnosis is questionable. The existence of such a tumor in the iris or ciliary body has, therefore, been postulated for the most part on the basis that leiomyoma does occur in other types of smooth-muscle tissue. Most textbooks on the eye do not mention the possibility of such a growth, and the only references to this form of tumor are in a few comprehensive treatises on pathology and histology.

Henke and Lubarsch,[1] in their Handbuch make the following comment: "Myomata and myosarcomata of the uvea have been described many times, but the diagnosis is still not without question. In the first place, when smooth muscle is found in sarcomata it has not been shown that this takes part in the building of the new formation, but that it may be merely rests of preformed muscle fibers. Second, it does not seem definite that the structure in question always shows smooth-muscle cells. As Mitvalsky has shown, the differentiation of pathologic smooth-muscle fibers from other kinds of spindle elements in sarcomata is extraordinarily difficult."

Parsons[2] merely mentions the possibility of myoma of the iris, and refers to the case, described by Thompson, in which Griffith suggested this diagnosis in 1899.

According to Stengel and Fox,[3] leiomyoma occurs most frequently in the uterus, gastrointestinal tract, and ovaries, and is found less commonly in the walls of the vessels, the skin, the bladder wall, the kidney, and the nipple. It always arises from preëxisting unstriped-muscle fibers. Its characteristic structure consists of bundles of muscle cells running in different directions. Longitudinal sections show cylindrical nuclei and indistinct cell outlines. The protoplasm stains deeply with eosin. Between the muscle cells are collagen and the so-called myoglia fibrils. The whole picture resembles that of sarcoma, from which it can be distinguished by the greater regularity in the direction of the cells in the different bundles and the distinctly cylindric nucleus.

Mallory's[4] description of leiomyoblastoma or leiomyoma is quite similar to that of Stengel and Fox. Mallory defines this type of tumor as of mesenchymal origin with a tendency on the part of the tumor cells to differentiate into smooth-muscle cells. He describes the

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long spindle-shaped cell with the rod-shaped nucleus and the dense acidophilic cytoplasm. In the cuticle of the cytoplasm are longitudinal striations (myoglia fibrils) which are brought out by special staining. The fibrils are fine and separate except at the ends of the cells where they fuse and form coarse fibrils. The smooth-muscle cells are always surrounded by numerous collagen fibers, which bind them together and appear to be largely responsible for the density and toughness of the smooth-muscle tissue. The rate of growth of leiomyoma in any situation is slow. If mitotic figures are present, the tumor is clinically malignant and capable of infiltration and metastases.

The description of leiomyoma in other standard works on pathology does not differ from those just cited.

The studies of Ida C. Mann[5] on the embryology and development of the human eye leave little doubt but that the dilator and sphincter muscles of the iris are derived from the neural ectoderm. This marks them as being extremely primitive in type. They possess the power of contraction to light when all nerve paths have been blocked. The earliest development of the sphincter muscle takes place in about the fourth month of embryonic growth. The dilator fibers appear at about six months, that is, after the sphincter is definitely formed. Some difference of opinion exists as to whether these fibers arise from the sphincter and grow over the anterior epithelial layer or whether they are developed in its surface *in situ*. The fibers extend to the root of the iris, and fine longitudinal striations appear in the anterior third of the anterior layer of cells. These latter form a definite layer that never becomes vascularized and is never separated from the ectoderm by a layer of mesoderm. This layer of epiblastic cells remains in a more or less embryonic state.

Verhoeff[6] is the only observer in this country who has reported a case of leiomyoma of the iris. This was the first case in which differential staining was used (Mallory's phosphotungstic hematoxylin), and hence it was the first instance of this type of tumor in which the diagnosis could be verified histologically. According to Verhoeff, leiomyoma is characterized by the long spindle-shaped appearance of the cells, with their typical rod-shaped nuclei, the tendency of the cells to occur in bundles with the nuclei arranged in rows (palisade arrangement), and the presence of myoglia fibrils coursing along the cells and coalescing to form large fibrils at their terminal processes. Verhoeff called attention to a characteristic difference between myomata and spindle-cell sarcomata. "This," he says, "consists in the fact that myoma cells are truly spindle-shaped, whereas the cells of a uveal spindle-cell sarcoma are seldom if ever distinctly spindle-shaped, but terminate in or send off laterally several ill-defined, irregular processes which anastomose with neighboring cells and thus form a more definite syncytium." Verhoeff also stressed the benign character of leiomyoma.

In a review of the literature at that time, Verhoeff found three cases that had been reported as myoma of the iris and six cases diagnosed as myoma of the ciliary body. In addition, a case which Dreschfeld[7] described in 1875 as sarcoma of the iris, was cited as a probable instance of myoma. After a careful review of these cases, Verhoeff came to the following conclusions, which are more authoritative than any I could make from my own study of the same cases; hence I quote:

> In regard to the question as to whether any of the tumors previously described as myomata of the iris or ciliary body were really such, it is impossible, in the absence of differential staining, to arrive at a positive conclusion. It is

reasonably certain, however, that the tumor described by Thompson[8] and examined microscopically by Griffith was a true myoma. The spindle cells were arranged in bundles and possessed rod-shaped nuclei. While many such nuclei may often be found in spindle-cell sarcomata, the nuclei are not predominantly rod-shaped. In addition to this, the illustration of this tumor shows that there was a definite tendency for the nuclei to be arranged in rows, leaving zones free from nuclei. There is some probability that the tumor described by Van Duyse[9] was also a myoma of the iris, owing to its long duration, 20 years, and to its not having produced glaucoma or affected vision. From the meager histological description of this tumor, however, it can not be differentiated from a spindle-cell sarcoma.

Owing to the fact that the ciliary body consists largely of smooth muscle, it would seem that a myoma was more likely to occur here than in the iris. In none of the six cases of supposed myoma of the ciliary body reported, however, is it possible, from the histological description given, to be reasonably sure that the tumor was not a spindle-cell sarcoma. In fact, I regard it as almost certain that the tumors were all spindle-cell sarcomata.

I have reviewed all these earlier cases, and, of course, cannot add anything to Verhoeff's conclusions regarding them. Since Verhoeff's report, two cases described as leiomyoma have been reported in the literature. The first was a case of leiomyoma of the ciliary body reported by Velhagen[10] in Germany, and the other, by Bossalino[11] in Italy, was called leiomyoma of the ciliary body and of the iris. In neither of these instances does the pathologic picture described quite justify the diagnosis, according to the description of leiomyoma by most general pathologists and the criteria set forth by Verhoeff.

Velhagen's patient was a woman, aged fifty-seven years, who consulted him because of a cataract in the left eye. In addition to the cataract he observed some distortion of the pupil. A closer examination revealed the presence of a black tumor which seemed to extend from the periphery of the inner surface of the iris, but continued definitely inward along the wall of the globe. This was diagnosed clinically as a melanotic sarcoma of the ciliary body and the eye was enucleated.

In his pathologic report Velhagen says that the tumor arose in the ciliary muscle and finally included the entire ciliary body. The tumor consisted principally of a basic fibrous tissue, which took on almost the same hue, when subjected to the van Gieson stain, as did the healthy portions of the ciliary muscle. The tissue was irregularly interspersed with cell nuclei, which only rarely showed protoplasmic substance, but otherwise greatly resembled, in size and formation, the normal muscle nuclei of the ciliary body. The nuclei of the region which corresponded to the pars circularis of the ciliary muscle were often round; those belonging to the region of the pars radialis and base were spindle-shaped. The chromatin design was quite clear; cell-division formations appeared nowhere. In addition, Mallory's method of differential staining was used with negative results.

Despite these findings, after excluding sarcoma and other tumors, Velhagen justifies his diagnosis of leiomyoma in the following terms: "Consequently the only remaining possibility is to describe this tumor as a leiomyoma of the ciliary body. Even though no specific reaction has so far pointed to this conclusion, still the similarity of the coloring of the tumor fibers with those of the normal pars meridionalis of the ciliary muscle was significant. Moreover, one had the definite impression that these portions of the growth lying within the pars circularis were the oldest."

In the case reported by Bossalino[11] in Italy, the evidence for the diagnosis of leiomyoma is even more vague. His patient was a woman, aged sixty-eight years, who had had a number of hemorrhages into the anterior chamber of the right eye, and finally consulted the oculist because of annoying, although not severe, pain in

the right eye and forehead. Examination revealed the presence of a large nodule in the lower internal quadrant of the anterior chamber. This growth seemed to be connected with the iris and extended until it occupied the region corresponding to the iridocorneal angle; toward the center it extended two to three millimeters beyond the edge of the pupil. It was yellowish-pink in color. The anterior surface, which was flattened out, did not adhere to the posterior surface of the cornea. The portion of the iris not invaded by the neoplasm appeared to be normal. The eye was enucleated.

Bossalino reports that the whole mass of the tumor seemed to consist mainly of fairly wide bands of tissue, forming larger or smaller spirals, some of which surrounded zones less elongated in appearance and having irregular borders. Elongated or round spaces full of blood were seen in the midst of this newly formed tissue. The predominating cells are described as fibroblasts, and certain degenerative and necrotic changes were noted. Since this tumor was apparently not subjected to differential staining, the diagnosis of leiomyoma can not be accepted without question.

The following report is of a case that I have observed recently:

The patient was a married woman, forty-six years of age. I had examined her eyes periodically for six years. The tumor was first noticed in August, 1934. It was a small, circumscribed nodule, yellowish-gray in color, the surface near the pupillary border being dotted with pigment. There was also an ectropion of uveal pigment at this point, producing a somewhat pear-shaped pupil. This ectropion was about one millimeter in width and showed the radial columns of dark-brown pigment of the posterior surface of the iris. It suggested that the iris had been turned inside out by the contracture of the tissues in the anterior layers. The growth appeared to have increased the thickness of the iris about one millimeter, and extended from the pupillary margin to a little more than half the width of the iris (fig. 1, frontispiece).

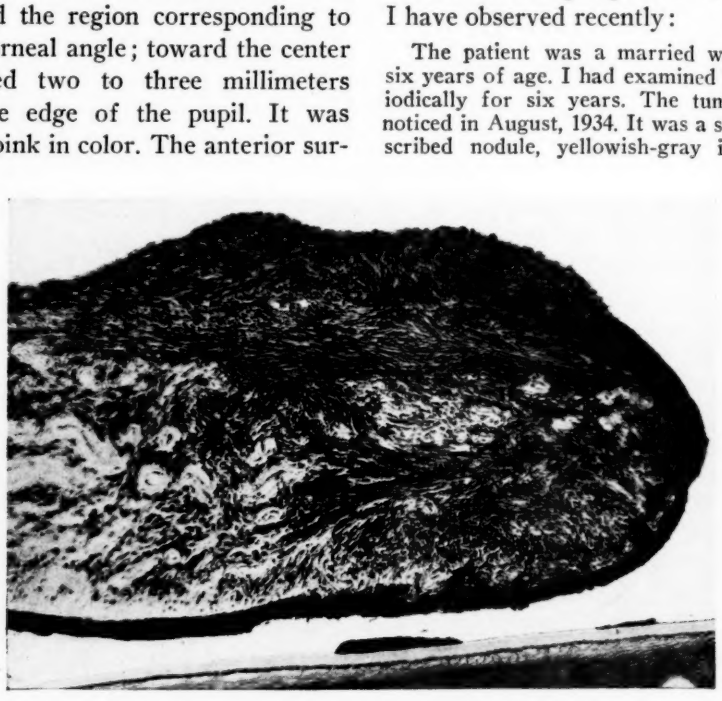

Fig. 3 (Frost). Low power, showing interlacing bundles of tumor cells invading the sphincter area. The position and direction of the bundles suggest that their contraction has produced the ectropion.

The mass was somewhat wedge-shaped with its apex toward the pupillary margin and extended from about the four- to the six-o'clock position. The thickest portion was nearer the pupillary margin and gradually became thinner toward the root of the iris. Small blood vessels were visible in the stroma, making their

way in the iris tissue from the periphery toward the mass. A dilated and tortuous anterior ciliary vessel was seen in the same sector as the tumor. There were no precipitates on the posterior surface of the cornea and no evidences of active inflammation. The fundus in both eyes appeared to be normal.

The patient had no pain nor other symptoms and suffered no impairment of vision. The tumor gradually increased in size until, in six months, it was about twice as large as when it was first noticed. During this time the patient was seen by a number of consultants, of whom Dr. Clarence King was the first. It was his opinion that the growth might be of inflammatory origin. Hence exhaustive physical and laboratory tests were made, but since all the findings were normal, Dr. King thought that the possibility of an atypical tuberculous nodule must be considered.

In November, as the patient was to be in New York, I advised her to see Dr. John M. Wheeler. Dr. Wheeler believed the neoplasm to be a sarcoma and advised that its progress be watched carefully. Three or four months later, on her return from Florida, she consulted Dr. Alan C. Woods, who was of the opinion that it was a malignant sarcoma and that the eye should be enucleated at once. He strongly advised against an iridectomy for biopsy.

I removed the patient's eye in March, 1935. Needless to say, her anxiety during the period of observation was great, and the removal of the eye and the pathologic report relieved her fears, so that she was much happier for having the eye out and knowing that the tumor was not malignant than she would have been had the eye been retained and the malignancy of the growth uncertain.

Dr. A. B. Reese and Dr. John M. Wheeler, of New York, collaborated in the histologic studies. Dr. Reese's description of the specimen was as follows:

"The cornea shows an irregularity in the thickness of Descemet's membrane peripherally, with the appearance of posterior excrescences (Henle's warts). The sclera inferiorly is pierced by a large intrascleral nerve loop at the level of the posterior portion of the ciliary body. The anterior chamber is of normal depth and the angles well open. Schlemm's canal is dilated and of good size. The pupillary two thirds of the iris below is occupied by a rather dense, moderately vascularized tumor which extends on the anterior surface of the iris nearly to the iris root (fig. 2). The tumor is composed of interlacing bundles of closely packed elongated spindle-shaped cells with considerable granular eosinophilic cytoplasm and long oval nuclei. In cross section the nuclei appear round. The tumor is of greatest thickness at the level of the sphincter iridis, with which it appears to be continuous (fig. 3). There are a few scattered chromatophores in the tumor tissue. No mitotic figures were seen (fig. 4). At the iris root below there is a compact group of cells containing brown granular pigment. There is a small degree of ectropium uvea. The ciliary body and choroid show no

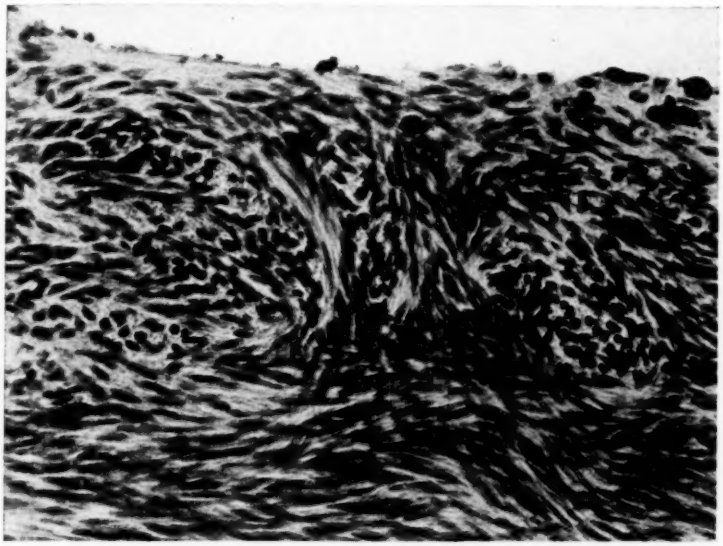

Fig. 4 (Frost). High power. Cell bundles cut longitudinally and transversely. Rod-shaped nuclei with palisade arrangement.

abnormalities. There is peripheral cystic degeneration of the retina. The optic disc and nerve are normal."

Differential staining by the gold-impregnation method (fig. 5) also revealed the presence of the characteristic myoglia fibrils, and the diagnosis of leiomyoma of the iris was made. A section was sent to Dr. Verhoeff and he concurred in this diagnosis. In his opinion, the close relationship of the tumor to the pupillary border and the sphincter muscle suggests that it arose from the latter, but, on the other hand, this evidence cannot be regarded as conclusive because the tumor cells may simply have invaded and intermingled with the cells of the sphincter. However, in any case, if Mann's conclusions regarding the development of this tissue are correct, the tumor must be regarded as of epiblastic origin.

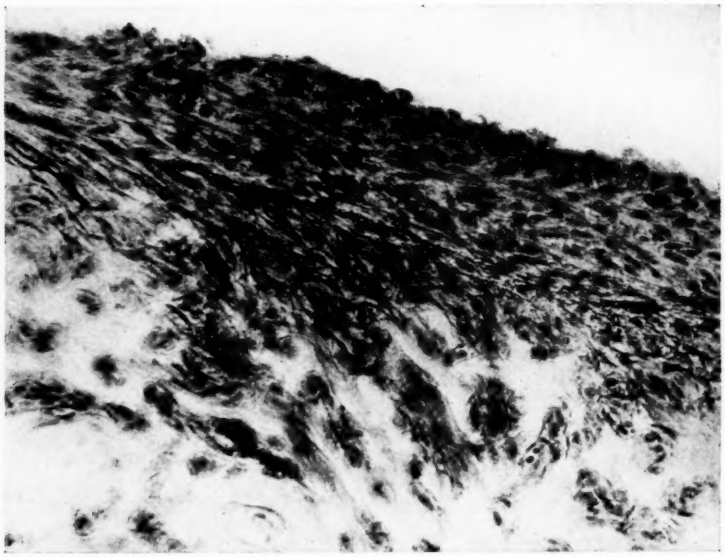

Fig. 5 (Frost). Showing myoglia fibrils by gold-impregnation method.

With present knowledge it is impossible to make a clinical differentiation of leiomyoma from sarcoma. The diagnosis can be made only as the result of microscopic study, and even then it may be difficult to determine definitely whether the tumor derives from smooth-muscle fibers. Whether the factor of iris ectropion can be considered as a valuable clinical sign in the diagnosis of leiomyoma can be determined only by observation of other cases. The question to be determined is whether these modified smooth-muscle fibers retain their contractility, presumably without a nerve supply, and thus cause the ectropion.

Summary

1. A case which must be regarded as leiomyoma of the iris is described. It is the second case in which the pathologic findings are sufficiently definite to justify this diagnosis. The other case was reported in 1923, by Verhoeff, who reviewed the literature and contributed an excellent description of the pathologic histology of this lesion.

2. Two cases which have since been reported as leiomyoma by Velhagen and by Bossalino are questionable in that neither of these authors demonstrated the presence of the characteristic myoglia fibrils by differential staining.

3. Clinically, leiomyoma is relatively benign. Its outstanding pathologic characteristics include a structure of interlacing, closely packed bundles of spindle cells with rod-shaped nuclei in palisade arrangement, displaying eosinophilic cytoplasm and myoglia fibrils.

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STUDIES ON THE INFECTIVITY OF TRACHOMA*

V. Purification of the infectious agent by testicular passage

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The preceding studies from this laboratory on the transmissibility of trachoma to monkeys confirmed the work of former investigators on the infectious character of the disease. Further experiments conducted to define the infectious agent have shown that the success of the experimental infection is not dependent for implantation on the conjunctiva upon a previously existing state of malnutrition; that it is not bacterial in nature; and that under conditions still poorly understood, it is capable of traversing Kieselguhr filters on rare occasions. Nevertheless, while the observations intimate that the incitant of trachoma may be a virus, the almost constant presence of bacteria in the human tissues employed for animal inoculation, and the inability to eliminate the bacteria with any degree of regularity render the evidence, however suggestive, inconclusive. The desirability is obvious, therefore, of transmitting trachoma in greater frequency with tissues liberated of the organisms occurring on the trachomatous conjunctiva.

In order to gain this objective, the expedient of passing trachomatous tissues through rabbit testicle has been adapted to this study. This technique had been employed by several workers in investigations concerned with vaccine virus, but it was Noguchi[1] who first utilized it as a step in purifying this virus of accompanying bacteria. The results obtained with this technique in the purification of the infectious agent of trachoma extend, in this report, the observations described in a preliminary presentation before the American Academy of Ophthalmology and Otolaryngology.[2]

Methods

Material for study was obtained at the Trachoma Hospitals of Rolla, Missouri,

* From the Oscar Johnson Institute, Washington University School of Medicine. Conducted under a grant from the Commonwealth Fund of New York.

and Richmond, Kentucky.** The tissue removed from the conjunctiva of each patient by grattage was suspended in 1.5 c.c. of veal infusion broth (pH 7.8). Upon return to the laboratory, suspensions from different patients were pooled and triturated under sterile conditions, and the ground material was inoculated in monkeys to determine the original infectivity of the tissues, and rabbits, also, were injected in one testicle with 0.5 c.c. Following preliminary investigation, the routine was adopted of removing the inoculated testicle under ether anesthesia ten days to two weeks following injection. After reserving a portion for histological sections, impression smears, bacteriological and tissue cultivation, the remainder of the testicle was ground in a sterile mortar and inoculated into monkeys, usually by swabbing the upper conjunctiva of one eye and injecting the other eye subconjunctivally following multiple pricking with the charged needle. At the same time, injection of the testicular material was made in other rabbits in order to study serial passage. In a few experiments, original injections were also made in guinea-pig and monkey testicle, but the most consistent results were obtained in rabbits.

Experimental

To illustrate the effectiveness of this method, it is proposed to describe a single typical experiment in detail. The material from two patients, pooled after the interval of four hours required for transportation to the laboratory, was prepared as outlined above. Two rabbits were injected into the left testicle with 0.5 c.c. each, and several monkeys were inoculated by swabbing the upper conjunctiva of both eyes. Within two weeks, the monkeys gave evidence of typical infections, which subsided in about two months.

One week following injection, the inoculated testicle of one rabbit was removed, and after being prepared as described, it was inoculated into two monkeys. In one monkey a typical infection developed within three weeks, while the second animal remained normal. Two weeks following injection, the inoculated testicle of the second rabbit was removed and in a similar manner inoculated into four monkeys. All four animals showed signs of experimental trachoma within two weeks, and the infections persisted for several months. In this particular experiment, then, the results indicate that the infectious agent of trachoma is recoverable one and two weeks following intratesticular injection of rabbits. The increased activity in the monkeys inoculated with material from the second rabbit is only apparent, since other materials showed differences in one direction or the other that were undoubtedly referable to variation in the individual susceptibility of monkeys.

In this manner, 20 experiments were performed in all. To facilitate presentation of the data and discussion, however, the results of only 10 experiments are compiled in table 1. Since the data given in this protocol are typical, a reasonably accurate impression of the total experiments may be gained from the curtailed information without unnecessary duplication. Thus, it will be seen that the number of tissues pooled is given with a statement as to the presence of inclusions in the tissues. Infectivity after rabbit testicular passage is compared with the original infectivity, and finally observations on the presence of inclusion bodies in both the rabbit and monkey tissues are also given.

A summary analysis of the data of the 20 experiments reveals that material for

** Material was obtained from these hospitals through the kind coöperation and good will of Drs. C. E. Rice and J. E. Smith, and Dr. Robert Sory, respectively.

TABLE 1

TESTICULAR PASSAGE IN RABBITS OF HUMAN TRACHOMATOUS TISSUES TEN TYPICAL EXPERIMENTS*

Experiment Number	Number of Human Tissues		Infectivity		Presence of Inclusions in	
	Pooled	With inclusions	Before passage	After passage	Rabbit testicle	Monkey conjunctiva
T_{36}	2	0	Positive	Positive	Negative	Negative
T_{37}	3	2	Positive	Negative	Negative	Negative
T_{44}	2	0	Positive	Positive	Negative	Negative
T_{51}	1	1	Positive	Positive	Negative	Negative
T_{53}	5	4	Positive	Negative	Negative	Negative
T_{38}	3	0	Negative	Negative	Negative	Negative
T_{40}	3	1	Negative	Negative	Negative	Negative
T_{46}	2	0	Negative	Positive	Negative	Negative
T_{47}	2	1	Negative	Negative	Negative	Negative
T_{49}	2	2	Negative	Negative	Negative	Negative

* Twenty experiments were performed in all, as explained in the text.

the experiment was derived from single patients, or that material from two to nine patients was pooled. In 10 experiments, the original material proved to be noninfectious, while in the remaining 10, experimental trachoma was induced in monkeys following their inoculation. With the 10 materials of demonstrated infectivity, four were unable to infect monkeys after rabbit testicular passage, and six retained their original ability to infect. Of the 10 materials originally noninfectious, two were capable of infecting monkeys specifically after testicular passage, and eight remained noninfectious.

An attempt was made to correlate infectivity of either the human or rabbit tissues with the presence of inclusions. The data summarized in table 2 disclose that of the 10 infectious tissues, which represented 22 patients, inclusions were found in nine; of the six retaining infectivity following testicular passage, the tissues were derived from 12 patients, four of whom showed inclusions; while in the remaining four, there were 10 patients with five possessing inclusions. In this series of experiments, it is obvious that the mere presence of inclusion bodies did not dictate infectivity of a given human tissue either before or after testicular passage.

Of the 10 experiments with tissue originally noninfectious for monkeys, the data in the two that were infectious after testicular passage reveal that of tissues pooled from five patients, only one showed inclusions. In the other eight experiments with tissues remaining inactive after passage, it is seen that 26 patients contributed material and five possessed inclusions. While with these materials the frequency of inclusions is lower than that found in the experiments with infectious tissues (approximately half as great), nevertheless the proportion of inclusions in infectious and noninfectious tissues

TABLE 2

RELATION OF INCLUSION BODIES IN HUMAN TISSUES TO INFECTIVITY BEFORE AND AFTER TESTICULAR PASSAGE

Infectivity of Tissues		Number of Experiments	Number of Tissues	
Before passage	After passage		Pooled	With inclusions
Positive	Positive	6	12	4
	Negative	4	10	5
Negative	Positive	2	5	1
	Negative	8	26	5

after passage is approximately the same (1:5) in both. It would seem, therefore, that the low proportion of inclusions observed in the originally inactive human material was fortuitous and not particularly significant, since the values are so nearly alike in both infectious and non-infectious rabbit tissues after passage.

If, on the other hand, the relationship of inclusions to infectivity following testicular passage is analyzed, it will be seen that 17 tissues, with five originally containing inclusions, retained their ability to infect monkeys. There were 36 tissues, 10 of which possessed inclusions, with no infective capacity following testicular passage. Thus, it is seen that the proportion of inclusions is roughly the same in both instances, so that it is difficult to see how the presence of inclusions in the original tissues exhibits any direct influence on infectivity demonstrable with rabbit passage.

TABLE 3

TESTICULAR PASSAGE IN RABBITS OF TRACHOMATOUS TISSUES FROM SINGLE MONKEYS

Experiment Number	Duration of Disease before Passage weeks	Infectivity	
		Before Passage	After Passage
M_{16}	10	Positive	Positive
M_{108}	5	Not done	Positive
M_{61}	7	Negative	Positive
M_{191}	4	Positive	Negative
M_{206}	6	Not done	Negative
M_{168}	8	Not done	Negative
M_{101}	10	Negative	Negative
M_{152}	10	Negative	Negative

For purpose of control on specificity, material obtained as described from 10 patients with folliculosis and from two patients with a chronic infectious conjunctivitis of undetermined etiology was studied in a similar manner. On no occasion, however, was it possible to demonstrate the presence of an infectious agent in the rabbit testicles, since their inoculation in the eyes of monkeys evoked no response. Another experiment was performed with hog-cholera virus which was first proved fatal for hogs. Inoculated into monkeys directly or following passage in rabbit testicle, it failed to induce any reaction of the conjunctiva.

The evidence indicates, therefore, that the infection induced in monkeys by the passage technique described is specific of the infectious agent of trachoma.

Before preparing the testicular material for inoculation of monkeys, sufficient tissue was removed for histological examination and bacteriological and tissue cultivation. Impression smears were made from the cut surfaces of the testicle and these were stained by the Gram method for bacteria and by the Giemsa method for inclusion-body elements. Except for a minor degree of inflammatory reaction in occasional rabbits, probably referable to the adventitious bacteria originally present in the human material but subsequently excluded, the tissue changes of the testicle were negligible. This coincides with the clinical observation that none of the rabbits injected with trachomatous tissues presented any signs of a general or local reaction.

Examination of the stained impression smears for bacteria invariably revealed no organisms. Similarly, despite careful search for inclusions, nothing suggesting either elementary or initial bodies was ever found. Inoculations of emulsified testicular tissues made on several bacteriological media were found to be sterile except for rare occasions when a few colonies of Staphylococcus albus were isolated. Tissue cultures made at the same time were also found to be free of bacteria. It is not desirable at this time, however, to enter into a lengthy description

and discussion of tissue-cultivation methods as applied to this tissue or trachomatous material, since this subject will be dealt with appropriately in a subsequent communication. The important point is that as far as can be determined by present methods, the infectious agent of trachoma is liberated of the frequent bacteria usually accompanying it.

An experiment was undertaken to transmit the infectious agent of trachoma in series through rabbit testicle. Despite repeated attempts, it was not possible to achieve this purpose. Occasionally, the infectious agent was carried through a second and even a third rabbit when it was lost or became completely attenuated. This experience is similar to that already reported[3] in attempting to adapt permanently the infectious agent to the conjunctiva of monkeys. In another way, it is evidence of the highly developed specialization of the trachomatous agent for certain tissues.

In addition to the experiments with material from patients, a study was made of the intratesticular passage of infected tissues from monkeys. Material was obtained from the animals in the same way, and all subsequent manipulations paralleled those with the human tissues. These experiments have been summarized in table 3. It will be seen that material was used individually from eight monkeys in which the duration of the experimental disease varied from four to 10 weeks. In five instances, the material was tested before passage and found to be infectious in two; in the others, monkeys were not inoculated. Following rabbit testicular passage, the infectious agent was recovered in three of the eight trials. In one instance, material originally failing to infect monkeys was found to be infectious following testicular passage, while in another instance, material of proved infectivity before passage failed to infect after passage. In the other complete experiments, however, the infectivity preceding and following passage remained constant.

TABLE 4

CEREBRAL PASSAGE IN RABBITS OF HUMAN TRACHOMATOUS TISSUES

Experiment Number	Number of Human Tissues		Infectivity		Presence of Inclusions in	
	Pooled	With inclusions	Before passage	After passage	Rabbit brain	Monkey conjunctiva
C_{4-5}	4	0	Negative	Positive	Negative	Negative
C_{4-6}	2	0	Negative	Positive	Negative	Negative
C_{4-3}	2	1	Negative	Negative	Negative	Negative
C_{4-7}	2	1	Negative	Negative	Negative	Negative
C_{4-8}	2	0	Negative	Negative	Negative	Negative
C_{4-9}	2	2	Negative	Negative	Negative	Negative
C_{3-6}	2	0	Positive	Negative	Negative	Negative

Thus it is seen that material from experimentally infected monkeys may be passed through rabbits, still retaining its infectivity and becoming bacteriologically sterile. As in the case of human tissue, the reaction is irregular and manifests occasional discrepancies in infective capacities before and after passage. These disagreements serve to emphasize the difference in resistance of individual monkeys rather than indicate an acquisition or loss of infectivity by the original tissues. It is because of this marked variation in susceptibility that it becomes necessary to

conduct experiments in trachoma on a statistical basis, if the risk of inaccurate conclusions is to be minimized or avoided.

The purification and survival of the infectious agent of trachoma in rabbit testicle suggested the possibility of adapting it to brains of animals, particularly rabbits. Material from patients was therefore injected intracerebrally in mice (Bar Harbor, C-57 strain), rabbits, and monkeys. Pooled or individual suspensions, collected as indicated above, were inoculated in quantities of 0.025 c.c. in mice, and 0.25 c.c. in rabbits and monkeys. Two weeks following injection, the animals were killed, and the inoculated hemisphere was ground after specimens for bacteriological and histological study had been obtained. The experiments with mice and monkeys were entirely unsuccessful and need not be considered further. In rabbits, however, the results deserve comment.

The experiments on cerebral inoculation of rabbits have been arranged in the form of a protocol, as will be seen in table 4. A study of the data reveals that seven experiments were undertaken in all, with pooled tissues from two to four patients. By some queer chance, the occurrence of inclusions in these patients was remarkably low (in only four out of 16). Of the seven pooled tissues, only one induced experimental trachoma in monkeys, although after cerebral passage the infectious agent was not demonstrated. In the remaining tissues, all failing to infect monkeys, two proved capable of infecting monkeys specifically after cerebral passage. This variation in activity has already been commented on in the experiment on testicular passage and therefore requires no further discussion.

As in the case of testicular passage, no histological changes referable to the trachomatous agent were found in the brains of the rabbits. Occasionally typical virus encephalitic lesions were observed, but these were subsequently determined to be due to Encephalitozoon cuniculi (an organism without effect on monkeys),[4] since the typical forms were found in sections of these brains. Smears for bacteria and inclusions were negative for both, and bacteriological cultivation yielded no growth. Thus, it has been possible to pass the trachomatous agent intracerebrally through rabbits on two occasions and at the same time eliminate the bacteria present.

Further attempts at cerebral adaptation by serial passage from rabbit to rabbit were unsuccessful, since recovery of the infectious agent was extremely irregular and it was not demonstrated even in the second passage.

Discussion

In studying purification of the infectious agent of trachoma, the technique of testicular passage in rabbits has been adapted to this problem. The evidence acquired from the experiments already described in this connection indicate that trachomatous tissues from both man and monkey may be completely liberated of the extraneous bacteria usually present on the conjunctiva during this disease. While irregular in its execution, the method permits the infectious agent to retain its infectivity a sufficient number of times to support the conclusion that trachomatous tissues free of bacteria may still be specifically infectious for monkeys. Thus, of a total of 27 experiments including tissues from both man and monkey, testicular passage of the agent was successful in 11 instances.

The absence of any reaction, clinical or histological, in the rabbit, the inability of the infectious agent to survive serial passage, and the maintenance of infectivity

following survival at an approximately given level, all indicate that the infectious agent of trachoma does not multiply in the rabbit testicle, but is merely preserved over an interval of time sufficient for elimination of the bacteria. Thus, then, despite its limitations, the method of intratesticular passage justifies its original purpose.

In experiments conducted to study preservation of the "virus" of trachoma under a variety of conditions, Nicolle and Cuénod[5] inoculated a rabbit intratesticularly with human material in a single trial and found 37 days later that the ground tissues of the inoculated testicle were able to induce trachoma in a Macacus inuus. In a second experiment, Nicolle[6] reported an inability of rabbit testicle inoculated in the same way 30 days previously to infect another animal of the same species. More recently, Oba and Kondo[7] report that simultaneous injection of trachomatous material and an aqueous extract of bull testicle induces a more or less severe reaction in rabbit testicle. After two or three days there is swelling followed within a few days by reddening and edema of the scrotal sac and hemorrhage of the parenchyma. One strain was passed through 12 rabbits. From the information available, however, it is difficult to determine whether these lesions were actually associated with the infectious agent of trachoma. Certainly in our own experiments, as well as in the two of Nicolle, no effect was observed in rabbits following intratesticular injection of trachomatous material.

Further experiments in this study were conducted to adapt the infectious agent of trachoma to cerebral tissues of rabbits. It was not possible to accomplish this purpose, however. While the indications are that cerebral passage may also succeed in liberating the trachomatous agent from accompanying bacteria, it does not lend itself so readily to this end as does testicular passage.

Successful intratesticular or intracerebral passage of the infectious agent of trachoma in rabbits does not seem to be dependent upon the presence of elementary or initial bodies in the original tissues. What significance is to be attached to this observation, however, is not clear. Assuming for the sake of discussion that the inclusion is an actual phase or concomitant feature of the infectious agent, it must be confessed that lack of propagation in the testicle and implantation, even though successful, in an animal as resistant as the monkey, both furnish little if any opportunity for the development of inclusions.

Summary and conclusions

1. The infectious agent of trachoma may be liberated of extraneous bacteria by passage through rabbit testicle.

2. The infectious agent does not multiply during such passage, but retains its viability and infectivity.

3. No changes are observable in rabbit testicle during passage which are referable to the agent.

4. It was not possible to continue passage in series through rabbits.

5. Survivability in testicular tissue is not related to the presence of detectable elementary or initial bodies.

6. On other occasions, the infectious agent may be freed of bacteria by intracerebral inoculation of rabbits, in which case the brain tissues show no specific reaction.

7. The cumulative evidence, therefore, suggests that the infectious agent of trachoma may be a virus.

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STUDIES ON THE INFECTIVITY OF TRACHOMA*

VI. CULTIVABILITY OF THE INFECTIOUS AGENT IN TISSUE CULTURES

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The consecutive studies undertaken in this laboratory on the etiology of trachoma suggest that the causative agent of the disease is a virus. Specifically infectious tissue from patients and monkeys may be separated from accompanying bacteria by passage through rabbit testicle and still retain its original infectivity.[1] Macerated testicular tissue in such instances is bacteriologically sterile and the infectious agent present therein is unable to multiply in a wide assortment of bacteriological media tested. It is an obvious development, then, in continuing the investigation, that propagation of the infectious agent be determined under conditions of tissue culture. Moreover, successful cultivation of the infectious agent of trachoma would solve automatically the difficulties and inconveniences experienced in this work because of the irregular availability of suitable patients for study and the inability, thus far, to adapt the infectious agent permanently to the various animals tried. That growth of the viruses of a number of diseases has been realized, as that of Saint Louis encephalitis in this laboratory,[2] serves to accentuate the desirability of undertaking the experiments to be reported in the present communication.

METHODS

Source of material. Material collected from patients** by scraping the conjunctiva with a sterile platinum spatula was suspended in cold Tyrode's solution. In some instances, tissue cultures were prepared immediately in the operating room, in others the suspensions were packed in ice and cultures were seeded upon return to the laboratory three to four hours later. Fragments of tissue obtained by grattage were also cultivated in a certain number of the cases. The technical difficulty of surface contamination by the saprophytic bacteria of the eye was avoided as much as possible by thorough irrigation of the conjunctival sac and subsequent washing of the fragments of tissue through several changes of Tyrode's solution before inoculations into culture media were undertaken.

Numerous other cultures were made with tissues obtained from the testicle of

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TABLE 1

COMPOSITION OF TISSUE-CULTURE MEDIA STUDIED

Method	Container	Ingredients					Inoculum	Final Condition
		Tissue	Plasma	Tissue extract	Serum	Tyrode's solution		
Minced chick embryo	50-c.c. Erlenmeyer flask, plugged with cotton, sealed with tin foil	.02–.03 gm. finely minced embryo	none	none	none*	5 c.c.	Several small fragments of tissue (or 0.2 c.c. filtrate)	Fluid suspension
Minced testicle	50-c.c. Erlenmeyer flask, plugged with cotton, sealed with tin foil	.02–.03 gm. minced testicle	none	none	none**	5 c.c.	Several small fragments of tissue (or 0.2 c.c. filtrate)	Fluid suspension
Minced kidney	50-c.c. Erlenmeyer flask, plugged with cotton, sealed with tin foil	.02–.03 gm. minced kidney	none	none	1 c.c.	4 c.c.	Several small fragments of tissue (or 0.2 c.c. filtrate)	Fluid suspension
Placental clot (a) original preparation	Carrel flask stoppered with rubber cap	—	0.25 c.c.	0.25 c.c.	none	0.25 c.c.	1 to 3 small (1 c.mm.) fragments of tissue	Tissue adherent or embedded in clot
(b) nourishing fluid		—	none	0.25 c.c.	0.25 c.c.	none		
Plasma clot on slides	Hanging-drop culture slide	—	1 drop	1 drop	none	none	1 small fragment of tissue	Tissue adherent or embedded in clot

* In about half of the cultures in minced chick embryo, the proportion of serum to Tyrode's was 1 c.c. to 4 c.c.
** In about one fourth of the cultures in minced testicle, the proportion of serum to Tyrode's was 1 c.c. to 4 c.c.

rabbits and guinea pigs, and from the brain of rabbits, monkeys, and mice previously inoculated with trachoma material.[1] Inoculated organs were removed aseptically and the fragments obtained for tissue culture were washed in Tyrode's solution before explanation. Tissue from the conjunctiva of monkeys was obtained after repeated irrigation of the everted lids with sterile saline and subsequently handled as described for the human material. All tissues from animal sources were used immediately.

Methods of culture. Because of the elaborate nature of the methods employed in the experiments on tissue cultivation, it seems advisable to describe in detail the techniques of the various preparations. To illustrate in a simplified manner the different compositions studied, a protocol of six types of culture preparations has been summarized in table 1. Chick embryos were removed aseptically from the shell after 8 to 10 days of incubation, washed, and after the eyes were removed, minced finely with scissors. Cultures were prepared in 50-c.c. Erlenmeyer flasks with small amounts of tissue (0.02-0.03 gm.) suspended in either 5 c.c. of Tyrode's solution or a mixture of 1 c.c. of serum and 4 c.c. of Tyrode's solution. After inoculation with a few fragments of tissue (or with about 0.2 c.c. of filtrate) from patients or experimental animals, the flasks were plugged with cotton and sealed with tin foil. In addition to the minced chick-embryo medium developed by Li and Rivers,[3] similar preparations with minced rabbit testicle, minced rabbit kidney (Maitland medium[4]), and guinea-pig testicle were employed. In a few instances, cultures were prepared in the same way with Brown-Pearce tumor tissue from rabbit testicle.

In addition to cultures in minced-tissue medium, inoculations of tissue fragments were made into the fertile egg according to the technique of Woodruff and Goodpasture[5] and of Burnet and Galloway,[6] and further cultures were made using the plasma-clot methods of Carrel.[7] The plasma-clot methods involve the explantation of tissue into a coagulum of plasma and tissue extract. Plasma from the patients themselves was heparinized and utilized in approximately half the cultures of tissues from patients. In a few cases, normal plasma from chickens or heparinized plasma from monkeys or rabbits was employed. The remainder of the human-tissue cultures was undertaken with heparinized human plasma from normal individuals. In all the cultures of animal tissues, however, homologous plasma only was used.

Tissue extract for cultures of human and monkey tissue was obtained from human placenta, from chick embryo, or from both sources. When placental tissue was available, it was minced and extracted with Tyrode's solution 24 hours before use and tested for sterility. If the extract proved sterile on bacteriological culture, it was used with Tyrode's solution and plasma to prepare the clots. When extracts were contaminated, they were filtered through Berkefeld V filters and then mixed in equal quantity with freshly prepared chick-embryo extract. For cultures of tissues from other animals, extracts were prepared from young adult tissue, as spleen, kidney, or testicle of the same species.

Plasma-clot cultures were prepared by embedding small (*ca.* 1 c.mm.) fragments of tissue in the plasma-extract mixture before coagulation occurred, or by fixing the tissue to the surface immediately after coagulation of the plasma. In a few instances, cultures were prepared with normal rabbit-testicle-tissue fragments which had been incubated to-

gether with trachoma filtrate for 30 minutes before explantation into culture media. Cultures in Carrel flasks (D-2.5) were made with a total volume of 0.75 c.c. of medium, and the flasks were secured with rubber stoppers or with cotton plugs and rubber caps. Hanging-drop cultures were prepared with a fragment of tissue implanted into (or on) clots, made with one drop of tissue extract and one drop of plasma, and sealed with paraffin. Usually as many separate cultures were made as there were fragments of tissue available, although two or three fragments were occasionally explanted in some of the flasks. Cultures on slides were transplanted after 48 hours without dividing the tissue. In Carrel flasks there was often some liquefaction of the clot after 24 or 48 hours. If so, the clots were reinforced by adding 0.5 c.c. of freshly mixed plasma and tissue extract. In any case, flask cultures were washed with Tyrode's solution and nourished with fresh extract and serum at 48-hour intervals until inoculated into monkeys.

After the cultures were seeded, they were incubated at 30-or 32°C. and at 35- or 37°C. for a period of three to eight days. A number of cultures were incubated under anaerobic conditions, as recently described by Dochez, Mills, and Kneeland.[8]

Experimental

During the course of experiments on propagation of the infectious agent of trachoma, a total of 1,175 cultures were made from materials obtained directly or indirectly, by way of animals inoculated with human material, from 140 patients with trachoma. Approximately half of the original 494 cultures of human tissues contained bacteria of the types usually encountered in bacteriological cultures from the human conjunctiva.[9] Success in obtaining so large a proportion of bacteriologically sterile cultures was unexpected. It was probably referable chiefly to the occurrence of very few bacterial cells on the conjunctiva of uncomplicated trachoma, and to careful irrigation of the conjunctival sac immediately preceding operation. It was previously noted that very few colonies developed on bacteriological media inoculated with material obtained by scraping the conjunctiva and that such material was occasionally sterile. In some instances, cultures containing bacteria, as well as bacteria-free cultures, were deliberately inoculated into separate monkeys. In general, however, contaminated cultures were discarded after smears were made to determine the presence of inclusion bodies. Cultures from monkey conjunctivae showed a much greater incidence of bacteria. However, the cultures from testicle and brain of passage animals were almost always uniformly bacteriologically sterile.

Plasma-clot cultures of conjunctival tissue usually, though not always, exhibited a small outgrowth of new cells. No attempts were made to transplant these cultures over long periods. Examinations were made at the time of inoculations into monkeys to ascertain whether the cells were in good condition. Much more vigorous growth was obtained with cultures of testicle tissue derived from rabbits and guinea pigs. While it was not possible under the present conditions of knowledge to determine whether the trachomatous tissue inoculated into minced tissue medium remained alive, it is nevertheless fair to assume that the cells retained their viability at least as long as those of the medium (that is, five days).

The accumulated data on the cultures of tissues from patients are summarized in table 2. A few cultures made with filtrates of trachomatous material are also included. Five different culture methods

were employed besides that used for filtrates. Thus, 191 cultures in chick-embryo medium were made from 31 patients. Eight of these patients had been found by examination to possess inclusion bodies, and material from 11 of them was infectious for monkeys. On the other hand, none of the cultures were found either to contain inclusions or to infect monkeys when inoculated conjunctivally. Similarly, with the plasma-clot method, 228 cultures were prepared from 47 individuals, 20 of whom possessed inclusions and 29 primary cultures was made with tissues (or filtrates) from the conjunctivae of 82 patients with trachoma. Sufficient material was obtained by grattage at the same time from these patients for inoculation into monkeys, and almost half (39) were proved to be infectious at the time of cultivation. The infectious agent, however, neither multiplied nor survived in the cultures. Nearly half (225) of the cultures were made from patients who possessed inclusions. Repeated examinations of the cultures failed to reveal the

TABLE 2

SUMMARY OF 494 TISSUE CULTURES WITH MATERIAL FROM PATIENTS

Culture Method	Number of Patients			Number of Tissue Cultures		
	Studied	With inclusions	Infectious	Studied	With inclusions	Infectious
Minced chick embryo	31	8	11	191	none	none
Plasma clot,						
(a) Patients' tissues	47	20	29	228	none	none
(b) Filtrate of patients tissues	12	5	9	21	none	none
Minced rabbit						
(a) Testicle	5	3	none	10	none	none
(b) Kidney	6	3	3	20	none	none
Fertile egg	9	3	3	24	none	none

of whom supplied material which infected monkeys. Many of the cultures of this series were also inoculated into monkeys without noticeable effect. Repeated smears of both the residual explanted tissue and the young proliferating cells failed to reveal the occurrence of inclusion bodies in any of the plasma-clot cultures.

The experiments with minced rabbit-testicle and kidney cultures, filtrate cultures and fertile eggs were similarly negative with regard to infectivity and inclusion-body development. While in these series the number of cultures made was small, the results when considered in conjunction with those of the preceding experiments did not warrant further pursuit of the methods.

To summarize, then, a total of 494 presence of either intracellular inclusions or initial or elementary bodies.

In addition to cultures made with tissues from trachomatous patients, over 600 primary cultures were conducted with tissues from animals which had been inoculated with material from trachoma patients. Tissues from each animal studied were explanted into one or more of the following media: (1) chick embryo, (2) rabbit testicle, (3) Brown-Pearce tumor of rabbits, (4) rabbit kidney, (5) guinea-pig testicle, and (6) mouse spleen and kidney, all prepared as described above by suspending finely minced tissue in Tyrode's solution or in homologous serum diluted with Tyrode's solution; (7) routine explants into coagula of homologous plasma and extract were performed, and (8) a number of

inoculations were made into developing chick embryos.

The most satisfactory method for simultaneous preservation of the infectious agent of trachoma and elimination of bacteria had been found to be passage through the rabbit testicle.[1] Therefore, a large proportion of the passage animal tissues subjected to tissue cultures was taken from this source. While five methods of cultivation were utilized, most of the cultures of infected rabbit testicle were made by the plasma-clot method or in minced normal-rabbit-testicle medium. Tissues from infected testicle tumor and brain of rabbits, brain of mice and monkeys, peritoneal exudates of mice, and conjunctival tissues of monkeys were each cultivated in a number of instances on two to four varieties of medium. Tissue obtained from passage animals was inoculated into tissue cultures and into monkeys at the same time. With the exception of cultures from the monkey conjunctiva, bacterial growth in the tissue cultures was rarely encountered. The absence of bacteria in tissue cultures, as well as on bacteriological media, inoculated with tissues of proved infectivity for monkeys, is corroborative evidence that the nature of the infectious agent of trachoma is nonbacterial.

In order to determine the presence of the agent of trachoma in the cultures, monkeys were inoculated with triturated material of pooled tissues from 4 to 12 or more cultures. Such inoculations were given after cultures had grown for several days but before the end of the incubation period of animals injected with the original tissue material. Therefore, some of the inoculations were made with cultures from animals whose tissues were noninfectious. This necessitated the injection of a larger number of monkeys than otherwise would have been necessary. In each group where cultures had been made from infected tissue, at least some of each kind was injected into monkeys.

The essential data from experiments with cultures of passage animal tissues have been summarized in table 3. The data have been arranged in such a manner as to convey the number of cultures made from tissues known to contain the active agent of trachoma, as well as cultures from tissues not infectious for monkeys. Explants were made from the testicle of

TABLE 3

SUMMARY OF 681 TISSUE CULTURES WITH MATERIAL FROM ANIMALS*

Animal	Tissue	Number of Tissues		Number of Tissue Cultures			
		Studied	Infectious	Methods	Studied	From infectious materials	Infectious
Rabbit	Testicle	43	16	5	384	148	none
	Tumor	4	none	2	40	none	none
	Brain	9	3	4	80	14	none
Guinea pig	Testicle	5	4	4	37	25	none
Mouse	Peritoneal exudate; Brain	6	2	2	48	30	none
Monkey	Conjunctiva	5	5	3	32	32	none
	Brain	6	none	4	60	none	none

* Neither elementary nor initial bodies were ever found in infected animals or in tissue cultures.

43 rabbits into 384 cultures in five kinds of media. Of these, 148 were obtained from 16 animals of proved infectivity, but none of the cultures proved capable of infecting monkeys. From 35 other animals, separated in the table into groups according to variety and source of tissue cultured, 297 cultures were initiated; approximately one third of them (101) were made from 14 animals whose tissues were infectious for monkeys. Thus, in comparable manner, 681 primary cultures were grown from tissues of 78 animals, 235 of which were made with explants from 30 animals of proved infectivity. In no instance was a monkey successfully infected with tissue-culture material.

Discussion

The experiments undertaken in this study with the purpose of cultivating the infectious agent of trachoma have embraced a wide variety of cultural methods and conditions. Tissue cultures from a total of six animal species (chicken, mouse, guinea pig, rabbit, monkey, and man) have been studied during the course of experimentation, and the physical environments have been altered to include a temperature range of 30- to 37.5°C., oxygenation from aerobiosis to anaerobiosis, and incubation from three to eight days. A large proportion of seedings were derived from tissues of verified infectivity and containing typical Halberstädter-Prowazek bodies. In some instances, the tissues cultured were contaminated with bacteria, and in others the tissues were bacteriologically sterile. Thus, it is seen that the variables deliberately introduced into the study of tissue cultivability of the infectious agent of trachoma have been both broad and numerous.

Careful examination of the tissue cultures regularly failed to reveal the presence of structures simulating either elementary or initial bodies. Inoculations of the tissue cultures in monkeys (M. rhesus) were completely without effect, even in those cases where the original explant or seeding was made from material of demonstrable infectivity. Consequently, it is obvious that the infectious agent was not only unable to multiply under the stated conditions, but it was not even able to survive.

On retrospective consideration, the results of this study render inevitable the conclusion that the infectious agent of trachoma is a virus of exquisite tissue specialization. It is characterized by a complete inability to infect lower animals irrespective of the route of inoculation. The infection it induces in monkeys is of a low order, healing as it does spontaneously without affecting the cornea or leaving any trace of its presence on subsiding. Even in man, where the virus grows best, however poorly, the infection is typified by an extremely circumscribed localization following a protracted onset. Experimentally or spontaneously, then, it is incapable of infecting more than the epithelial cells of the conjunctiva and its adnexa. It is not surprising, therefore, that it fails to grow in cultures of avian or foreign mammalian tissues. It was for this reason that the technique was conceived of cultivating in homologous plasma, as described above, epithelial cells from the trachomatous conjunctiva, which in a number of instances not only were infectious for monkeys but even contained inclusion bodies. While at the present time this device appears to be the closest *in vitro* approximation to the virus' normal habitat of the human conjunctiva, some subtle factors were obviously lacking in the cultures and growth did not occur. Whether the precise factors involved in the multiplication of the virus of trachoma will be transferable eventually *in vitro* remains for future investigation to determine.

Conclusions and summary

1. *In vitro* cultivation of the infectious agent of trachoma has been attempted by tissue-culture methods.

2. Tissue cultures from six different animal species have been employed, under a variety of conditions.

3. The temperature range during incubation varying from three to eight days has been from 30- to 37.5°C., and the tissue cultures were incubated aerobically and anaerobically.

4. Elementary or initial bodies have never been found in any of the tissue cultures.

5. None of the tissue cultures inoculated in monkeys were able to induce experimental trachoma, even though in many cases the materials from which they were derived were of demonstrable infectivity.

6. The results indicate an inability of the infectious agent of trachoma not only to multiply but even to survive under the stated conditions of tissue culture.

7. The data suggest that the infectious agent is characterized by a highly organized tissue specialization which renders *in vitro* cultivation extremely difficult with the knowledge available at the present time.

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PLEXIFORM NEUROFIBROMATOSIS (VON RECKLINGHAUSEN'S DISEASE) INVOLVING THE CHOROID, CILIARY BODY, AND OTHER STRUCTURES*

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Although several cases of neurofibromatosis involving the choroid have been reported, there has never been a discussion of the subject of ocular involvement in a session of this Society. In 1891 de Schweinitz[1] presented a paper before the Society entitled, "Neuroma of the right upper eyelid and adjacent temporal region." He gave a splendid description of the condition and made interesting references to the literature on neurofibromatosis. His patient, however, had no ocular involvement. In 1906 Herman Knapp[2] briefly reported to the Society a case of plexiform neuroma of the orbit and in 1912 Zentmayer[3] reported a case of plexiform neurofibroma involving the orbit and temporal region. In the discussion of Zentmayer's paper, Beard referred to the case reported by him and E. V. L. Brown. He mentioned ptosis and a peculiar pigmentation of the skin of the lids, also downward and forward displacement of the globe. Arnold Knapp,[4] in 1916, reported a plexiform neuroma of the orbit. He performed a Krönlein operation and found a neurofibroma at the apex of the orbit. MacMillan and Cone[5] reported, before the 1933 meeting of the Society, a case of solitary neurofibroma of the orbit and mentioned interesting views of the nature of the neurofibromatous process. O'Brien and Leinfelder,[6] in discussing unilateral exophthalmos before the Society in 1934, mentioned the removal of a neurofibroma from the orbit. I think it quite interesting that in not one of the six cases which have been reported to the American Ophthalmological Society has there been an involvement of the eyeball.

The case that I wish to describe is one of demonstrated neurofibromatosis, with coffee-colored spots on the body, thickening of the tissue of the right upper eyelid and the temporal region, involvement of the orbit, the optic nerve, choroid and ciliary body, the sclera and probably the hypophysis and structures in the middle fossa of the right side.

The patient, F. F., a female, aged 6½ years, was referred to me through the courtesy of Dr. Ivor G. Clark. The eyes were examined by Dr. Conrad Berens on the day after the baby was born, April 14, 1923. He reported that the right cornea was steamy and measured 11 mm. The left cornea was clear and measured 8.5 mm. The right pupil was 3 mm. in diameter, and was apparently fixed, not responding to light either directly or consensually. The left pupil was 1½ mm. in diameter, and reacted sluggishly to direct and indirect light. The tension with the McLean tonometer was 50 mm. Hg in the right eye and 25 mm. Hg in the left. When the infant was three weeks old Doctor Berens performed a trephining operation on the right eye with a 1½-mm. trephine, but as the tension was not greatly improved by the operation, he operated again, three weeks later, using a 2-mm. trephine. As a result there was adequate filtration of the aqueous, and the cornea cleared.

Dr. Albert D. Frost examined the patient, and on November 12, 1924, noted ptosis of the right upper lid with enlargement of the right side of the head and a swelling in the right temporal fossa. X-ray examination disclosed that the right orbit was considerably larger than the left, giving the impression that the orbital contents had increased in size, expanding the orbit in all directions and encroaching on the nasal cavity. There was no appreciable increase in tension of the buphthalmic eye.

I first saw the little girl on September 25, 1929, when she was about 6½ years old. There was no light perception in the right eye; vision was 20/30 in the left. The skin of the

* From the Institute of Ophthalmology of the Presbyterian Hospital. Read before the American Ophthalmological Society at Hot Springs, Virginia, June 1 to 3, 1936.

right upper eyelid was dark, and there was complete ptosis of the lid, with a tumorlike mass covered by conjunctiva and skin hanging down below the lower lid margin and causing an ectropion of the outer two thirds. The right eye was buphthalmic, and there were two operative colobomas above, with a good-sized bleb of bulbar conjunctiva and apparent thickening of the conjunctiva above the trephine wounds. The right pupil was dilated and fixed. There was ectropion of the iris, and the lens was cataractous and tremulous. The soft parts of the malar and temporal region of the right side were thickened, and this thickened tissue had a cordlike feel. No operation was performed at this time.

On October 2, 1930, at Babies Hospital, the lacrimal gland and tissue adherent to it, together with a mass of lid and subconjunctival tissue were dissected out and sent to the laboratory of the New York Eye and Ear Infirmary for diagnosis. Mr. E. B. Burchell reported on the patho'ogical tissue and rendered a laboratory diagnosis of neurofibroma of the region of the lacrimal gland.

August 23, 1932, the patient was again admitted to Babies Hospital for excision of tissue from the lid margin and from the surface of the globe. A finger was passed through the conjunctival wound back into the right orbit. Near the apex in the temporal wall a sharp, low ridge of bone could be felt, and behind, this there was a depression. Absence of bone at the apex seemed likely, but no tumor tissue could be felt at the apex of the orbit.

On August 31, 1932, Dr. Ross Golden reported as follows:

"X-ray examination of the skull and optic canals: Stereoscopic films of the skull in the right lateral and Caldwell positions disclose a marked asymmetry of apparently the lower head but particularly of the anterior part of it. *The right orbit is markedly enlarged.* Its lower margin is depressed so that the *right antrum is less than one half the size of the left.* The suture on the lateral aspect of the orbit is markedly widened. The right orbital roof is elevated but as far as I can tell is intact. The bones forming the lateral aspect of the orbit are apparently very thin, and the superior orbital fissure is markedly widened. In the lateral view it looks as though the right lesser wing of the sphenoid were displaced forward and the anterior clinoid on that side cannot be made out. The right frontal sinus is rudimentary. The left is markedly enlarged. The sella turcica is markedly enlarged. The dorsum is pointed. The posterior clinoids are either very short or absent entirely. The floor of the sella is well defined. This looks to me like the effect of long-continued pressure on the pituitary from above. It looks as though there must be a mass in the right middle fossa as well as in the orbit and probably above the pituitary which is responsible for the bony changes described above. The films in the Watters position are not satisfactory because of motion.

"A film of the optic canals shows the left to be normal. A right optic canal cannot be seen with certainty. I am not sure whether this is because the canal as such has been destroyed by erosion, or whether it has been so distorted along with the rest of the lesser wing of the sphenoid that it does not show up on the usual projection. There is an elongated, ovoid shadow with pointed ends lying in the lower inner quadrant of the right orbital shadow which might possibly be a greatly distorted, deformed optic canal."

On August 14, 1933, the child was admitted to the Eye Institute, and neurofibromatous tissue was removed from the right upper lid and temporal region. As a result of removal of lid tissue during the different operations, the ptosis had been partially corrected and the exposed right eye was unsightly. It was almost immobile and very soft. On June 18, 1935, the right eye together with adherent pathological tissue was enucleated. At the time of enucleation the orbit was palpated. Thickening could be felt in the roof and lateral wall of the orbit near the apex, with a ridge along the edge of the superior orbital fissure.

Dr. A. B. Reese rendered the following report of the laboratory examination of the globe and adherent tissue:

"Macroscopic: The globe is large and, particularly the cornea, shows a marked ectasia. Over the scleral surface temporally there is some extraneous fibrouslike tissue.

"Microscopic: The corneal epithelium is of irregular thickness, and between it and Bowman's membrane there is, in places, a lymphocytic infiltration. At other sites, Bowman's membrane is either missing or is quite thin, and between the epithelium and the underlying corneal stroma there is a vascular membrane with a lymphocytic infiltration. This is particularly true over the lower two thirds of the cornea where there are also many new-formed blood vessels extending into the corneal stroma. The posterior corneal surface is undulating and in places forms quite high ridges. Near the limbus above are two operative sites which are more or less filled with ciliary processes, remains of the iris, and scar tissue. The filtration angles are completely obliterated. The iris is shrunken to a small nub of fibrous tissue in which the only normal element seen is the sphincter muscle. This shows an ectropion. Along the anterior surface of what remains of the iris is a layer of pigment epithelium which extends around the filtration angle and for a

Fig. 1 (Wheeler). Photograph of F. F., showing elephantiasis of the right upper eyelid.

short distance along the posterior surface of the cornea. The lens is cataractous and has some calcium deposits in its anterior cortex. The retina is completely detached and drawn up into folds posterior to the lens, due to contracting scar tissue in the vitreous. The subretinal fluid contains cholesterin crystals and old hemorrhage. At the site of the ora serrata in the detached retina is a ring "Schwiele" in which is some bone formation. *The ciliary body and choroid are enormously thickened by the acquisition of tumor tissue which replaces all of the normal elements of the choroid and also the ciliary body, except some of its muscle bundles.* The tumor is composed of nonmedullated nerve fibers and many foci of ganglion cells. There are also large areas of spindle-shaped cells, the protoplasm of which contains pigment. In the choroid one notes many round to oval laminated structures with laterally arranged nuclei. The ganglion cells are not noted posteriorly in the choroid after the appearance of the above-mentioned laminated structures. Temporally, over the ciliary body, the tumor tissue is seen extending through the sclera and over the external surface. It is in this tissue, from the external surface of the globe, that infraperineural fibrosis is noted and not in the tumor tissue of the ciliary body or choroid. The sections of the optic nerve, stained by the Weigert method, show neurofibromatosis and complete atrophy of the nerve fibers, with no medullation seen. Also, no medullation of any of the nerve elements of the tumor was noted.

"Remarks: This is a von Recklinghausen tumor of the nerves of the ciliary body, choroid, optic nerve, and orbit. The laminated structures noted in the choroid are Meissnerian tactile corpuscles, which are found normally in the skin of the hands, feet, lips, and genitals. They appear abnormally in von Recklinghausen's disease and in pigmented moles, especially of the scalp. Because of the frequent association of pigment lesions on the skin with this disease, it is interesting to note the increase in the pigment-bearing cells of the choroid."

On July 5, 1935, Dr. Raymond Pfeiffer reported on the X-ray examination as follows:

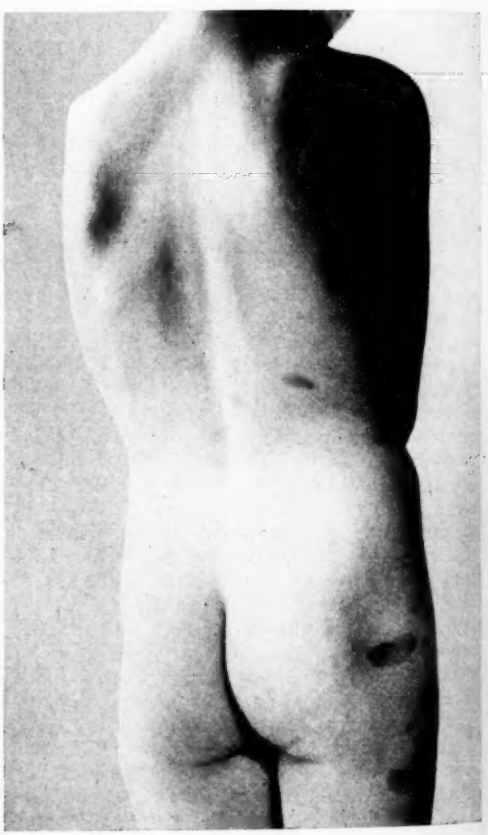

Fig. 2 (Wheeler). Photograph showing characteristic coffee-colored patches on the back.

Fig. 3 (Wheeler). Neurofibromatosis of the choroid. The choroid is entirely replaced by neurofibromatous tissue (× 50).

"Films of the skull show the asymmetry of the calvaria as previously described. The left calvarium and base are approximately normal while the right shows striking asymmetry which affects all parts. The calvaria bulge in the region of the point pterion and is thinner. The petrous bones are asymmetrical and the right temporal bone is scarcely pneumatized. The right middle fossa is greatly enlarged. The basal angle is approximately normal. The sella turcica is much enlarged and measures approximately 15 × 21 mm. There is scarcely any evidence of a right anterior clinoid process. A very deep fossa lies in the right tuberculum sellae. The striking asymmetry of the orbits appears as previously described. The left is normal. The right is greatly enlarged and deformed. The sphenoid ridge is forward and is higher. The sphenoid fissure is tremendously enlarged. The right ethmoid cells are compressed. There is scarcely any evidence of a right antrum. There is deformity of the right zygomatic zone and zygomatic arch. The optic canals are strikingly asymmetrical; the left is normal, and the right measures approximately 8 × 11 mm. The walls of the right canal are greatly thinned.

Impression: *The enlarged right optic canal seems to indicate neurofibromatosis of the contained optic nerve.* The sella turcica seems much larger than it was two years ago and suggests the presence of a tumor within."

Figure 1 shows characteristic extreme ptosis and enlargement of the right upper eyelid and pigment changes in the adjacent skin area. Scattered over the body, particularly on the trunk,

Fig. 4 (Wheeler). Neurofibromatosis of the ciliary body. Atrophied ciliary processes. Only suggestions of the original tissue of the ciliary body remain (× 50).

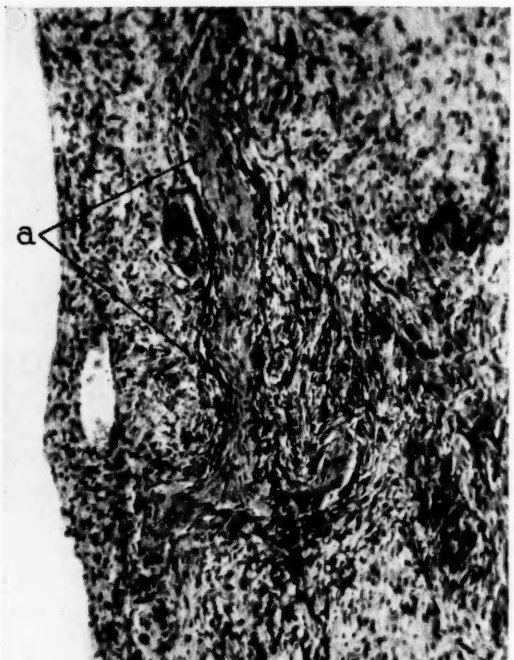

Fig. 5 (Wheeler). Neurofibroma of choroid. Lines from *a* point to the nervelike structure. Large cells (ganglion cells) can be seen (× 200).

were coffee-colored patches in the skin. Some of these are shown in figure 2. There were no fibrous nodules, no scoliosis, nor other pathologic bone changes outside of the skull, and no anomalies of any of the deep structures of the body.

Comments

Frequency of choroidal involvement. In the literature there are several case reports of neurofibromatosis involving the choroid. The involvement more often than not has been accompanied by buphthalmos. Cases with buphthalmos are reported by Snell and Collins,[7] Knight,[8] Sutherland and Mayou,[9] Murakami[10] Sachsalber,[11] Weinstein,[12] Wiener,[13] Collins and Batten,[14] and others. Involvement of the choroid without buphthalmos has been reported by Snell and Collins,[7] Callender and Thigpen,[15] Freeman,[16] L. H. Meeker,[17] and others.

The causes of buphthalmos in neurofibromatosis of the choroid have had little attention. Sachsalber[11] assigned the cause of buphthalmos to the disturbance of the lymphatic circulation with impeded outflow. Collins[7] found a broad adhesion of the iris to the posterior surface of the cornea; he suspected that these structures had never become separated during fetal

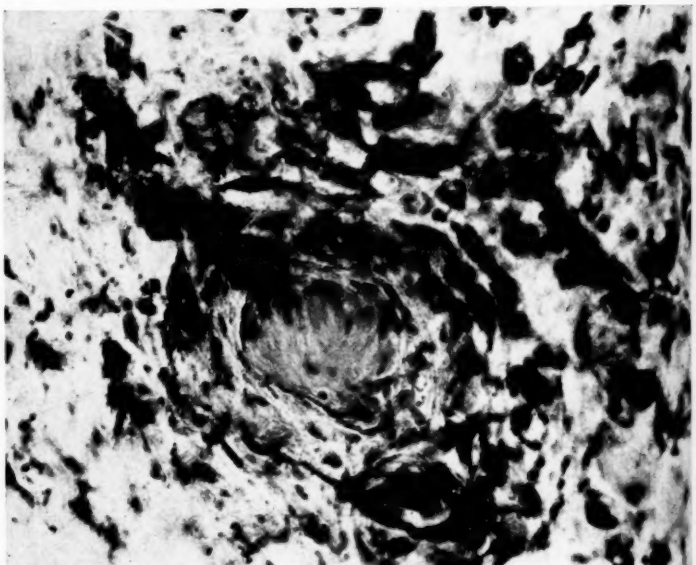

Fig. 6 (Wheeler). High magnification (× 550) of neurofibromatous tissue of the choroid to show palisading effect (tactile corpuscle).

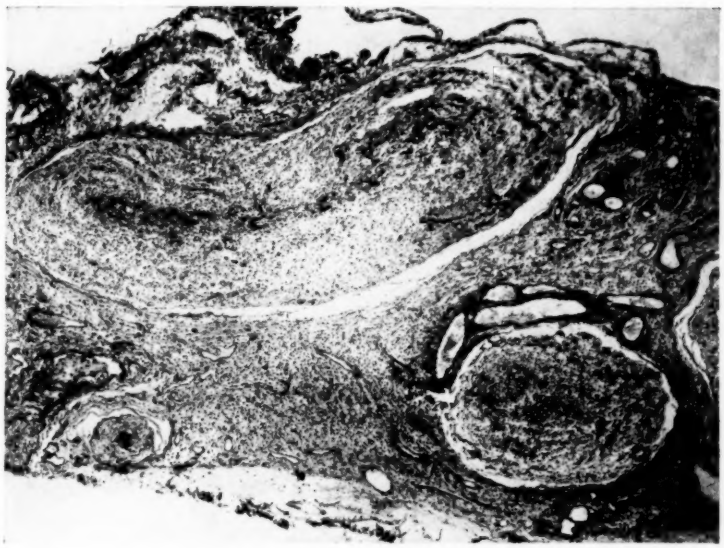

Fig. 7 (Wheeler). Extraocular extension of neurofibroma. This tissue extends through the sclera in the temporal ciliary region (× 70).

life and that the spaces of Fontana had not developed. Alfred Wiener suggested that the enlarged eye as well as the enlarged orbit might be due to simple cases of hyperplasia brought about through the same influence that induced the hypertrophy of the lid, and he suggested that the possible working of two factors might produce buphthalmos: the one, the fibrosis, and the other, a periodic increase of tension due to circulatory disturbances. Treacher Collins's explanation seems to me to be the most reasonable.

Pulsation of the globe. In 1903 Rockliffe and Parsons[18] called attention to the phenomenon of pulsation of the eyeball in a case of plexiform neuroma of the orbit. Ernest Clarke[19] also reported this phenomenon. In 1931 Foster Moore[20] called particular attention to pulsation of the eyeball in four cases of neurofibromatosis that he had seen. LeWald[21] and the author[22] have also called attention to pulsation of the eyeball in neurofibromatosis of the orbit. It would seem that in any case in which a large part of the roof of the orbit is absent, pulsation might occur. In the case here reported there are two possible reasons why pulsation was not manifest: One is that most of the roof of the orbit is intact and the communication with the cranial cavity is small and near the apex. The other possible reason is that the large globe was very soft and the thrust of pulsation from the brain might not be transmitted through the large, soft globe to its anterior part.

Changes in skeleton. Lehman[23] and Brooks and Lehman[24], Copeland, Craver, and Reese,[25] LeWald,[21] Camp,[26] and others have called attention to the frequency of changes in the skeleton in neurofibromatosis. Scoliosis is particularly common. In the case here considered no bone changes outside of the skull were found.

Medullated nerve fibers. Reese[25] described the presence of medullated nerve fibers in both eyes of a patient with neurofibromatosis. He called attention to a study of 12 patients with neurofibromatosis made by Fischer,[27] who found retinal medullated nerve fibers in four.

Spinal roots[25] and the spinal cord, as well as peripheral nerves, may be involved. Camp[26] reviewed the tumors of the spinal cord operated on at the Mayo Clinic between 1930 and 1932 and re-

ported that 23 percent of all the spinal-cord tumors operated on were neurofibromas.

The oval or ovoid bodies found microscopically in neurofibromatosis have had various interpretations. De Schweinitz[1] called them "oval whorls," and Collins[7] considered them "hypertrophied nerve-end organs." They have been referred to as "tactile corpuscles," and Reese likened them to Meissnerian corpuscles. Knight stated that these ovoid bodies have been designated Pacinian corpuscles, but that they are almost certainly "hyalinized whorls of fibroblasts," rather than nerve-end organs. This investigator gives an illustration of a wax reconstruction of the ovoid bodies as she found them in the choroid.[8] Haagenson[28] believes that we are not justified in using specific terms in referring to these ovoid bodies; that they should be described merely as having a laminated appearance with a palisading effect of the nuclei.

The cordlike feel of the neurofibromatous tissue was referred to as "moniliform" by Rockliffe and Parsons. To Zentmayer the tissue felt as if it were made up of "knotted cords." Herman Knapp said that the cords were like "vermicelli," Sutherland and Mayou that the tissue felt like a "bag of worms," while Beard used the intriguing reference "fiddle strings." When a piece of neurofibromatous tissue is excised and pressed between the thumb and the finger, small papillae project on the cut surface. These resemble the cut ends of false nerve trunks.

In the case reported here there was neurofibromatous involvement of the right upper eyelid, zygomatic and temporal regions, lacrimal gland, apex of the orbit, ciliary body, choroid, sclera, and optic nerve. X-ray findings point to probable involvement of the hypophysis and structures in the middle fosa of the right side of the skull. It is probable that the chiasm and optic tract were not seriously involved, for the field of vision of the left eye was not impaired. We cannot be sure of the accuracy of the field outline, as the child's fixation was faulty.

I am indebted to Mr. Nicholas Ross for the photomicrographs that are reproduced in this article.

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LECTURES ON CATARACT

IV. Posterior-segment complications in the postoperative period; some difficult extractions

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Detachment of the retina as an immediate postoperative complication is rare in our experience. Unlike detachments of the choroid, it is not so apt to subside with reattachment as the result of treatment. A single scleral trephining over the detachment with needle puncture of the choroid has resulted in cure. More modern diathermy methods should be similarly effective. Interference should not be delayed, but must necessarily involve a minimum of globe movement and pressure. Late detachment of the retina is not so uncommon following either method of extraction. Judging by a limited experience, modern methods of surgical treatment are not so satisfactory in these, as in the detachments of nonaphakic eyes, possibly because we seldom see an early case.

Glaucoma. Rise of tension of the posterior-segment type without obvious cause. Postoperative increase in tension has been previously mentioned in connection with shallow chamber; also as a sequel to various postoperative complications of the anterior and posterior segments. Persistent shallow chamber from a cause other than an increase in volume of the posterior segment may set up a glaucomatous state secondarily by closure of the angle; for instance, in the case of peripheral anterior synechiae, really due to anterior-segment causes but apparently of posterior-segment origin or type. Conversely, an obscure increase in posterior-segment volume which initiates a shallow anterior chamber may later still be further complicated by a closed angle. Such cases are probably of a preglaucomatous type at the time of operation, and our interference determines an early postoperative manifestation of the glaucomatous process.

It is easy to miss a rise in tension shortly after operation, since it is not desirable to interfere with the eye to any extent. If the eye is quiet and the chamber is shallow the effect of a miotic should be determined. Rising tension is met by eserine, but if it persists or tends to become accentuated a few weeks after operation, anterior sclerotomy or a modified Lagrange decompression is carried out; that is to say, some form of sclerotomy or sclerectomy, under a flap, in one of the lower quadrants.

Cyclodialysis may also be effective and, indeed, is preferable if the anterior chamber is so shallow as to render a sclerotomy dangerous. In a postintracapsular aphakia it is undesirable to buttonhole the iris with the knife at the time of performing a sclerotomy or sclerectomy. Late glaucoma revealing itself in a quiet aphakic eye is not necessarily dependent on our operation, but its appearance—predetermined—may have been accelerated or retarded thereby.

Asteroid hyalitis is a definite complication, but rare, and compatible with reasonable vision. We have noticed asteroid hyalitis of the Benson type associated with a considerable reaction after an intracapsular extraction in which the anterior condensing layer of the vitreous became thickened and the pupil adherent to it. This and other degenerations of the

vitreous are more likely to give trouble after an intracapsular than after a capsulotomy extraction.

Other lesions of the vitreous, choroid, optic nerve, or retina undetected before the extraction. I need hardly say that such posterior-segment lesions are sometimes a cause of disappointment, and are not necessarily appreciated by preoperative tests.

Erythropsia and cyanopsia need only be mentioned.

Aftercataract. Let us consider separately the elements taking part in its formation.

(a) Thickened anterior capsule. This ought not to play much part in the process if the anterior capsule has been effectively dealt with.

(b) Thickening of the posterior capsule. One hears little of such thickenings, but they are not so very rare, especially ringlike thickenings. They are better left at the time of operation and dealt with by needling.

(c) Pigment bands. Influence of blood at the time of operation or postoperative hemorrhage. Denser pigment lines and bands in the capsular web are often due to leaving strands of fibrin, which form lines of junction between portions of anterior and posterior capsule or connecting threads from pupil to capsule. These constitute late sequelae of hemorrhage into the chamber.

(d) Cortical remains. In our practice we see many more cataracts associated with a sectored cortex than are seen in western countries, and they have frequently to be operated on before the sectors completely liquefy. In such cases one is very apt to leave long threadlike floaters, in spite of thorough irrigation. These are responsible for iritis phakoanaphylactica and are apt to initiate a cellular proliferation of epithelial and mesothelial elements, and a pigment migration, thereby forming a dense postoperative web of aftercataract. Capsule, retinal pigment layer, and iris connective tissue may all take part in the process.

(e) Whatever cortex is left behind at the periphery an irritative reaction may take place, peripheral points of posterior synechiae or anterior synechiae may form. These also may play a part in aftercataract, on the one hand, or interference with the filtration angle on the other.

(f) Fibroblastic membrane. Certain cases show definite evidence of more extensive fibroblastic elements invading the scaffolding of capsule, fibrin, cortex, or whatever débris happens to be left behind. Such fibroblastic membranes are more obviously associated with inflammatory reaction and more common in eyes which have had some prior chronic uveal inflammatory trouble, where there were preoperative posterior synechiae, or where there was uveal involvement as a postoperative complication.

Fibroblastic activity may apparently take place in relatively quiet eyes where there is less obviously an inflammatory reaction, perhaps merely tissue trauma. Presumably the cellular elements may be derived from the connective tissues and vessels of the uvea and corneosclera traumatized during the operation, stimulated to activity by a quiet inflammatory reaction due to tissue trauma.

The extent and density of such elements in an aftercataract depend on the severity of the inflammatory reaction. Where the dividing line lies between tissue trauma, immediate and direct toxic irritation due to lens protein or iris pigment, and allergic effects of absorption of such tissue constituents, it is hard to say.

(g) Organizing vitreous face following escapes. Aftercataract is met with as a sequel to vitreous involvement in the section, with a shelving vitreous face with organization. A more or less opaque fibroblastic membrane binds iris, vitreous face, and section together.

Aftercataract Associated with Lesser

Degree of Vitreous Herniation than adhesion to the section. The vitreous face shows evidences of organization and adhesion to the iris face or pupil edges.

Aftercataract in Intracapsular Extraction. Rarely pigment and blood deposits on vitreous face and possibly old posterior synechiae may establish such a condition, especially in diseased conditions of vitreous. Lesser deposits of pigment granules on the anterior condensation layer do not often appreciably affect vision, and grade into the normal limits of the vitreous face after intracapsular extraction.

This may conveniently be regarded as of three main types: The flat face lying behind the plane of the iris and parallel to it; the small hernia or mushroom projecting as a low dome through the pupil; and the large mushroom or nailhead type projecting freely through the pupil and into the chamber, but free from attachment to pupil edge, iris face, or cornea. All these show a definite condensation layer sharply delimiting and containing the vitreous gel. Such herniae are not responsible for sequelae, for instance, glaucoma or irritable eye, whereas creeping vitreous iris-face adhesions or vitreous-pupil ring synechiae may be responsible.

Treatment of aftercataract, or of capsular webs which follow capsulotomy.

When Should a Needling Be Done? We prefer to wait some weeks till the eye is quiet. Sometimes it is desirable to free the pupil with a needle before the patient's discharge from hospital, should it have become bound down at one or two points, and then push atropine. Later the needling will be easier with a free iris.

How to Do the Needling. Ordinarily fine capsular webs are dealt with by a simple technique. The method now used is a modification of that introduced by Kirkpatrick many years ago. It may not be peculiar to this hospital, but is apparently not commonly used outside India. It consists of a series of light touches with a Bowman's needle, inserted through the cornea. This gives rise to a minimum of disturbance.

The Detail of the Technique. The needle is entered towards the center of one of the superior quadrants at about one third the distance between limbus and pupil center. It is held very lightly in an upright position, and allowed to penetrate the membrane almost by its own weight till the arrowhead is all but through. It is then raised clear of the membrane, and in the same linear direction as the first stab a second stab is made, and so on for three or four serial stabs. Thus a linear cut is made which gapes to an ovoid, as the vitreous herniates slightly. A cut of a few millimeters is sufficient. The needle is then drawn clear of the capsule, the handle depressed and its direction changed, so that it lies more nearly parallel with the iris face. It is thrust towards the angle in the inferior quadrant, and in this position given a few rapid turns between finger and thumb to detach any possible vitreous thread, and quickly withdrawn.

Rigid Aftercataract Membranes. Those which have existed for a long time may not respond to a simple cut. Instead of the cut gaping to an ovoid it still remains as a mere incision the following day. In such cases an arrowhead aperture is made.

The Aftercataracts of an Inflammatory Type Associated with Dense Membrane Formation. These may be dealt with in various ways. If the angles of the coloboma are adherent to the section and the face of the aftercataract is shelving towards the section, such as one finds after an impaction, the lower pupillary border may be either adherent or free. If free, it may be dealt with by cutting the sphincter below. If adherent, the pupil border may be separated through small keratome incision with needle or hook, and the

lower capsule viewed. In either case, the capsule behind the iris below may be relatively clear or, if not, may lend itself to simple needling. Every case must be treated according to whether there is any latent iridocyclitis still present or not. If there is we give a modified preliminary treatment as for uveitis.

If the eye is quiet and the tension normal the lower border of the pupil is gently separated through a keratome incision below, and if the membrane is fairly clear behind, the iris margin divided with a de Wecker scissors. If the tension is up, a Lagrange should be done below and the lower border of the pupil caught in a blunt hook and a marginal iridectomy performed. The decompression is essential in such circumstances. These plans depend on finding a less dense membrane behind the iris below, which may be needled later.

There are many other devices which may be utilized, such as iridotomy with a Herbert knife from limbus to limbus, vertical incision with a Wheeler knife, incising the face of the iris and membrane after the manner of Ziegler or de Wecker, but we should always give rise to as little disturbance as possible. If the associated iridocyclitis is not absolutely quiescent it is likely to be followed by a flare up and tension, due to plasmoid aqueous.

Every complicated aftercataract is a law unto itself as regards treatment, but the simpler the procedure and the less the trauma the better. We must aim at producing an effective aperture, with as little dragging as possible; and a small aperture is often better than a great ragged one. We deprecate dragging membranes out, although bold grasping and dragging may not be followed by an immediate flare up—in fact, the eye is apt to remain strangely quiet—such procedure is very frequently followed by anterior vitreous synechiae which determine late sequelae.

SOME DIFFICULT CATARACT EXTRACTIONS

In this class are unusual cases which are not put up for the ordinary routine extraction, but specially noted for removal of lens secundum artem.

The thickened capsule plaque, or irregularly thickened capsule in hypermature cataract. Sometimes we make a preliminary exploration with the needle. Such plaques, if central, are apt to detach readily with a touch of the needle. If so, this preliminary detachment with the needle is carried out, section made, the plaque removed with forceps, and the case dealt with as an ordinary capsulotomy. It will be found that although the plaque almost falls off at the touch of the needle, for the most part it frequently remains attached at one place, as if hinged. This readily tears when the plaque is grasped with forceps. Alternatively, a section with conjunctival flap is made, and the thickened capsule felt gently with a Kalt forceps. Should it come away with the gentlest movement without disturbing the zonule, the case is treated as a capsulotomy. Should it hold well, and very little hold is required in these cases owing to the weak zonule, it is dealt with as an intracapsular extraction.

Capsulotomy in total-sclerosis-type cataracts (brown and black cataracts). A capsulotomy with a knife, or a capsulotomy with a toothed capsule forceps, in cataract of the sclerosed-nucleus type, with a friable capsule and a narrow belt of cortex, is not always easiest or best. One of the most satisfactory procedures is to perform the section without any attempt at capsulotomy and then to remove as much of the capsule as possible with a toothless forceps, such as Kalt's or a modified intracapsular forceps with a cutting edge such as I have designed (a sort of punch forceps), and to complete the delivery with the needle, tilting the upper pole and wheeling the nucleus.

The torn zonule or subluxated lens and completely dislocated lenses. Such conditions may exist in old hypermature cataracts of a sclerosed type, where the zonule is perhaps dehiscent in part. Not all of these are detected before the patient comes on the table. It may also be met with in traumatic cases with a minor degree of subluxation (anterior dislocations). The method adopted depends on how the vitreous has behaved. If there is a partial herniation of vitreous the section is made as far away from the vitreous threat as possible with a Herbert knife; a large bridge flap is employed and negative pressure well established. The lens is then humored by gently stroking its face away from the section with a thin spatula or the flat of the needle till its upper edge appears, under which a very fine flat spatula is introduced and the nucleus slid into the anterior chamber between a repositor and the spatula, making gentle counterpressure outside the globe. When in this position it easily slides out between the inclined planes of the instruments. If the lens lies free in the vitreous and the vitreous has invaded the chamber (posterior dislocations), the best thing to do is to make a conjunctival flap and employ the vectis or spoon according to the size of the nucleus.

Collapsed morgagnian cataract with the nucleus lying in an empty bag. If the nucleus is open to view and there is no apparent vitreous invasion through a torn zonule, and no obvious hole in the capsule, a preliminary exploration with the needle is made and the capsule definitely torn centrally.

A relatively small section with a bridge flap is made, the nucleus slid out between fine spatulate repositors, and the capsule removed with forceps. Such a procedure leaves us in the same position as an intracapsular extraction. There is very little disturbance of vitreous.

Sometimes the nucleus is not visible and vitreous fluid as a rule has invaded the pupil or chamber. Here make a large well-flapped section. Vitreous will probably escape, certainly if fluid, and the nucleus come forward. If so, slide it out; if not, view it and use a vectis.

Morgagnian nucleus dislocated into the anterior chamber. The procedure depends on the size of the nucleus. Sometimes a keratome incision is sufficient. It is safer to make a larger section with a Herbert knife and a bridge flap. No iridectomy is done. If fluid vitreous is present, some is almost bound to escape and may subsequently form an adhesion with the wound. This cannot well be avoided. The nucleus is slid out with flat spatulate iris repositors, or with a curette and repositor. Here some control of the vitreous may be effected by eserine.

Spotted capsules in morgagnian cataract, or irregular thickenings here and there on the back of the capsule of the hypermature cataract, with a smooth capsule surface. These may be dealt with by capsulotomy and subsequent removal of the capsule with forceps. Alternatively by expression. Such cataracts are readily expressed, since the zonule is very feeble, and the fluid bag molds readily, bladder-like, through even a moderately dilated pupil.

Removal of cataract in a previously trephined eye. This is not necessarily a difficult procedure if the chamber is moderately deep.

A bridge flap may be made to one side of the trephine hole, the section being corneal opposite the hole; or, if there is a low extensive well-covered cushion of filtration, a large flap may be made right over the region of the trephine hole. This is sometimes wise if the tension is inclined to remain up in spite of the trephining. At the same time a broad iridectomy is performed. This flap seldom interferes with the functioning of the previous trephining.

The glaucomatous eye with cataract. With an empty chamber or one so shallow that it is hardly existent and a filtering scar above, one may adopt a combined capsulotomy-iridectomy section with a single maneuver of the knife. In such, the section is made through iris and capsule and carried through at the proper level, finishing with a bridge flap. One must be careful not to get the point of the knife caught in the nucleus.

Herbert's knife is used. The iridectomy is completed by dividing the sphincter in two places with a de Wecker scissors. This only applies if the iris wound in the first instance has been made by puncture and counterpuncture, it may be otherwise according to circumstances. It is surprising what good results may follow this procedure.

Very shallow chamber with acute secondary glaucoma due to intumescent cataract. This condition is very common with us and will be dealt with when speaking of secondary glaucoma. We avoid extracting the cataract when such eyes are in the acute glaucomatous state, and a broad iridectomy is the operation of choice. After a reasonable time, say three weeks or a month, the extraction is carried out. This may be done by making our section through the cataract similar to the above, if the anterior chamber remains shallow. In this case there is no complication with the iris since it has already been removed. Such eyes more often settle down after the iridectomy to a condition of normal tension and the chamber reforms in a most gratifying manner. They are then dealt with as ordinary morgagnian types, for, as a rule, the cortex rapidly liquefies completely after the relief of the tension.

Very shallow chamber in subtotal or total sclerosis. Here one may: (a) Fill the anterior chamber with the irrigator through a tiny keratome aperature or needle hole. (b) Make a combined capsulotomy-iridectomy and section with a Herbert knife, slowly passing across the face of the cataract, taking everything, iris and capsule, but not allowing the point of the knife to engage the nucleus.

Preglaucomatous states with shallow chamber where mydriasis may induce high tension not otherwise obvious. In such eyes, when the tension is likely to go up with cocaine or atropine, the retrobulbar injection nearly always lowers the tension on account of its adrenalin content; but if, on the table, the tension still seems higher than it ought to be under the circumstances, we make a bridge flap and a broad iridectomy. The capsulotomy is carried out with the knife if possible, or if not with forceps. A slow section, taking a capsule flap, tends to allow escape of lens matter along the knife and eliminate posterior-segment thrust. Massage prior to making the section is practiced.

Definite primary glaucoma with cataract. If, for some reason, waiting is undesirable and the cataract is ripe, we may extract under a bridge flap with a broad iridectomy, and snip off a piece of the deep wound with scissors to effect a sclerectomy filtering scar. In such cases the patient is suitably prepared beforehand by miotic treatment and so forth, as for a trephining. Pantocaine without atropine is used, and the eye is massaged immediately prior to operation. The retrobulbar injection lowers the tension at the time of operation. This constitutes a combined extraction-iridectomy-sclerectomy.

If there is no difficulty about postponing the extraction, or if the cataract is immature, we may perform a Lagrange below, or a trephining above, and later on an extraction in the ordinary way. We sometimes make a broad iridectomy alone, as a preliminary procedure, but in acute secondary glaucomas due to intumescent cataract or in other secondary glaucomas, a broad iridectomy is the rule,

preferably with a preliminary flap.

The bulging eye. Here some advantage may be obtained by a canthotomy. Should the lens matter be under tension in the capsule we perform a capsulotomy with the knife, and gradually let out lens matter whilst making a slow section. A fine knife with narrow blade or even a Herbert knife is preferable.

The removal of orbital fat in cases of exophthalmos may afford relief of pressure. No matter what the type of cataract, we favor capsulotomy and a large bridge flap in marked cases of bulging. The type of iridectomy must be decided at the time according to the behavior of the iris when completing the section and the previous depth of the chamber.

As mentioned before, if the proptosis is due to hemorrhage as a result of our retrobulbar injection, the operation may be postponed. We still freely use the hook for elevating the lids and allowing the orbital contents to fall back; but any modern good type of retractor serves when effective blocking is established.

The danger of spontaneous delivery or vitreous escape in such eyes has already been dealt with, and also the importance of tearing the capsule at once, should a spontaneous delivery take place under the flap, in case we have not done a capsulotomy before completing the section.

Leucoma adherens and cataract. Preliminary treatment with salicylates, arsenic, and mercury is often desirable. Preliminary iridectomy is nearly always advisable and essential if there is difficulty in viewing the lens. It is important to observe the reaction in iridectomy, for it gives us a guide as to how the eye will respond to the major procedure.

Subsequently a careful lenticular examination is made. The anterior synechia not dealt with by our iridectomy may be broken down or, better, cut free with a de Wecker scissors at the time of making the iridectomy. A reaction demands further treatment before extraction. Should the eye remain quiet, extraction may be undertaken in a couple of weeks if necessary. At the time of extraction, if the lens is lying fairly well back or in its normal place, the position is often most suitably dealt with by the procedure known as "wheeling out the nucleus" (see p. 386).

If the cataract is lying well forward, the pillars pressed against the capsule and possibly attached thereto by fine synechiae, we go through everything with the knife. If we feel reasonably sure that the eye will stand it—for instance, in a lesion of long standing without irritation—the extraction may be carried out at the first sitting.

Difficulty with a bridge flap in scar tissue. In cases of recent iridectomy in which it is particularly desired to make a bridge flap, it may be more difficult on account of the scar above. We may anticipate this difficulty if at the time of iridectomy we turn down a conjunctival flap before doing the iridectomy.

Old iridocyclitis with deep anterior chamber (possibly even of a sympathetic type).

Cataracta Complicata. The secret of getting success with this type of case seems to lie in preliminary treatment. They are dealt with, even if they are apparently quiet, as if we were treating them for sympathetic ophthalmia. Subsequently an iridectomy is performed, and if there are fairly simple posterior synechiae they are broken down at this time; but not later at the time of extraction, and not at all if they are extensive. If this does not appear to set up much reaction when a reasonable interval has elapsed—say, three weeks to a month—the cataract is removed by the capsulotomy method.

The capsulotomy may be done as a preliminary capsulotomy with the needle, or, if performed with forceps after the sec-

tion, it is executed very tentatively with a twist, not a drag. Put as little drag on synechiae as possible, and disturb the *status quo* as little as possible. Be content with an efficient aperture in the capsule, wheeling the nucleus out, and gentle irrigation; needling for aftercataract may be done later if necessary.

Microphthalmic eyes. In removing cataract from microphthalmic eyes, ample allowance must be made for the smallness of the cornea in fashioning our flap. The knife must be entered in the sclera opposite the angle and a section involving the diameter of the cornea is made with a bridge flap. In the majority of instances there is a coloboma downwards and so a complete iridectomy is never done, but a small peripheral buttonhole is desirable.

These cases as a rule are dealt with by the extracapsular method, and preferably by a preliminary capsulotomy with a needle prior to section, or if a forceps is used for the capsulotomy after the section it should be of a small-bladed type—a Kalt forceps serves well when used with a twist, not a drag. Finally, the nucleus is wheeled out with the needle. It must be remembered that we may have a dehiscence or coloboma of the zonule, which may lead to trouble if there is difficulty with delivery on account of an insufficient section.

Some surgical procedures and devices in connection with cataract extraction

Ectopia lentis. This condition is not very uncommon. It hardly comes under our title, although many cases show an immature cataractous condition. If the lens is uniformly cataractous, it may be successfully dealt with by linear and irrigation evacuation, provided the lens is well forward.

If immature or clear, needling is difficult and unavailable, since absorption does not occur to any extent in a vitreoid medium. We try to get the lens forward into the anterior chamber by postural means. It often arrives there spontaneously. Miotics may help to keep it in this position. The section is completed as a large bridge flap with a Herbert knife. Extraction is carried out by sliding a fine spatula under the lens and making counterpressure outside the globe (the technique referred to for dislocated lenses and free morgagnian nuclei). There is nearly always some escape of fluid vitreous.

We sometimes remove a lens from the anterior chamber by other means. In one case of this nature, the lens was fixed with a Bowman needle in the left hand and a large bridge flap made with a Herbert knife in the right hand. An iris repositor was slipped behind the lens, the zonule torn, the lens slid out between repositors, and eserine given. The result was comparatively good, but it is rarely that we get good results in such cases.

Zonular cataract. In zonular cataracts it is better for practical visual purposes to do an optical iridectomy rather than a discission. In case of doubt, iridectomy is advised. In order to get a nice result, we buttonhole the iris just outside the collarette and divide the bridge between this and the pupil. If examination under full mydriasis with slits does not give promise of practicable vision, discission with early linear and irrigation evacuation is resorted to; the evacuation, say, three weeks after a thorough discission.

Congenital cataracts. Congenital cataracts of the membranous type are always dealt with by preliminary exploration with the needle through the cornea. The subsequent procedure varies in every case, but the main idea is to detach at least a central portion of the anterior capsule, or its membranous representative, and ease away the opaque white matter beneath, using the needle rather like an oar. The more membranous and flattened the cataract, the more difficult the pro-

cedure. In cases in which the thickened layer of anterior capsule is contiguous with the posterior capsule, even with careful picking it may be impossible to detach a central mass without removing adherent posterior capsule and allowing a free thrust of vitreous through the aperture. This is sometimes unavoidable, but, having explored with the needle, a deliberate plan may be evolved as to how to deal with the problem, since such adherent posterior-capsule cases more nearly resemble ordinary dense aftercataracts. More often there is a line of cleavage and an adequate portion of the anterior layer can be detached together with some débris, and more often still the lens is of almost ordinary shape, whatever the contents of its capsule may be like. In the latter case it is an easy matter to do a thorough breaking up with the needle if the cortex is shrunken or pultaceous, or straightaway adopt the procedure of linear and irrigation evacuation, if soft or fluid. If any cortical or capsule matter has been freed by the needle, the chamber is filled through the needle hole with the irrigator and a keratome incision made at this point.

Any soft detritus is now washed out, and freed portions of capsule or cortex removed with forceps. Great care must be exercised in such cataracts, for it is sometimes tempting to be persistent and do too much, especially when it is found that the anterior and posterior capsules are adherent or adjacent, so that in attempting to set free intervening masses of cortex an accidental hole is made through which vitreous pours. One can always make another and perhaps better-informed attempt if too much is not done at the first sitting. Care must also be taken in pulling out thickened plaques of anterior capsule in these cases. We do not favor dragging such nuclear membranes out of the eye, with vitreous loss or an uncontrolled rush of vitreous into the anterior chamber. At all events this should be a last resort.

Juvenile cataract. Since in juvenile cataract the lens is most frequently normal in form and not so likely to be membranous, shrunken, or condensed, but rather of a soft type, it is commonly dealt with by what we call linear and irrigation evacuation. The keratome incision, about 4 mm., is made in the clear cornea in one of the upper quadrants. With the same movement the anterior capsule is pierced. The keratome, held close to the perpendicular up to this time, is depressed and the blade flattened out as it enters the capsule. The keratome is entered at the junction of outer and middle thirds of the radius. The contents of the capsule are then stirred with an iris repositor, and complete evacuation, if possible, with the irrigator, at one sitting is carried out.

The corneal incision should be fairly vertical but must be valvular; it is better to leave a wider opacity than to err too much in the former direction. One finds many varieties of juvenile cataract, hard and soft. The latter may be dealt with at one sitting and the patient allowed to attend as an out-patient. The cure is immediate, and the vision can be dealt with at the end of the week.

Hard varieties may be broken up carefully, between a narrow spatulate iris repositor and the back of the cornea. With a little patience and a little experience with the irrigator, these also can be dealt with at one sitting. The use of our own model of irrigator nozzle and our method of irrigating are more impressive to the uninitiated in these procedures than in any of its other uses.

Anesthesia in Children for Cataract Extraction.

Good anesthesia is essential, but in small children chloroform is often unde-

sirable, inasmuch as it gives rise to psychic shock and much straining on coming round. Certain children of five years and upwards stand intravenous injection of sodium evipan without becoming worried or excited by the actual injection. European children with us are more intolerant, and the trouble of giving intravenous injection is as great as chloroform; possibly the psychic effect is even greater.

Disadvantages of sodium evipan are movements of the limbs, jerking of the head, sneezing, restlessness on coming round, possibly vomiting. In spite of these, we consider it a great advantage in operations on the eyes of children and in certain very excitable adults.

Dosage Note: 10-c.c. solution equals 1 gram of powder. Give 2 to 4 c.c. to children; 6 to 10 c.c. to adults. When the jaw drops give as much again. Should there be evidences of collapse and failure of respiration, Coramine (Soc. Chemical Indust., Basle) or Icoral solution, 5 percent (Bayer), may be used. In emergency, large doses are indicated and the intravenous method adopted; for instance, 2 to 5 c.c. of Coramine.

For young children under five (behavior age), we have been led to use avertin. This is an excellent method and even the youngest children can be put to sleep without a whimper with the mother in attendance. The detail is as follows: The dosage of avertin (Bayer) in powder form is 0.2 gram per kilo. This is made up in a 2-percent solution in saline at body temperature. For example, a child weighing 22 lbs. is given 2 grams in 100 c.c. Formerly it was directed to be given in a 2.5-percent solution, and this required heat which could not be over 40°C., as decomposition was liable to result, giving rise to rectal irritation. The solution was tested with congo red. Even when using the more dilute solution, it is advisable to test with congo red or B.D.H. indicator before giving the rectal injection. Wash the rectum out afterwards before the patient leaves the theater. Occasionally damage to mucous membrane has been reported, giving rise to proctitis. We have not seen it, and the method has been used in thousands of cases by general surgeons of experience without untoward results. It is advisable to cocainize gently and block before starting an operation. Paraldehyde has been recommended for use in the same way on account of the cost of avertin, but we have not found it suitable.

The ripening of immature lenses in adolescents who are losing their employment on account of interference with vision. A certain number of cases in this category come our way. It is important for them that they should not lose their livelihood. Often these cataracts are of the pale nuclear type, rather than the posterior subcapsular which might conceivably be dealt with by capsulotomy. The patients are too old to needle. The zonule is too strong to justify removal with Barraquer's apparatus.

We employ various ripening processes: A section with massage of the capsule is probably the best. We have tried application of the erisiphake and releasing it; but even when the nucleus displaces up under the anterior capsule, the resulting opacification was no more rapid than when we used massage, and of course the procedure is more dangerous. It sometimes happens in such cases that we are able to do a cataract extraction in a few months.

Method of cutting vitreous bands. When a vitreous band or thread is free from the face of the iris, but connects the vitreous face in the pupillary area with the section, a useful method of dividing it is by a keratome incision at a point opposite the attachment of the band, and the introduction of a de Wecker scis-

sors to snipping the band. This should be done with as little disturbance as possible; nothing will come away with the de Wecker scissors, if great care is taken.

Wheeling out the nucleus in cataract extraction. The procedure is usefully employed in the following types amongst others: the large nuclei of sclerosed cataracts (total and subtotal); hypermature cataracts with large flat nuclei; cataracts with narrow shrinking cortex, atrophic zonules, and friable capsules; immature posterior subcapsular cataracts.

It sometimes happens when performing a capsulotomy operation that the nucleus is difficult to start, or it may be that when making a complicated cataract extraction under a large bridge flap, the center of the capsule comes away in the gentle bite of the toothless forceps; and one is not sure as to the size of the nucleus nor the condition of the zonule and vitreous, so that it is feared even to do the ordinary dipping of the posterior lip of the wound with counterpressure at the lower limbus. In such circumstances the method is useful.

Let us assume that there is a bridge flap. The bridge is raised with an iris repositor in the right hand or left hand, as the case may be, the needle is introduced laterally on an angle of about 30 degrees to the plane of the iris, its point is engaged in a shallow bite near the upper pole of the nucleus, pushed gently, and elevated with a paddling motion till the nucleus starts rotating in its bed. Successive grips are taken with the needle, and slight elevating movements made till the upper pole presents and the nucleus comes away readily.

This technique is most useful in many different types of difficult extractions by the capsulotomy method, in addition to those instanced.

Desirability of making a bridge flap opposite a source of pull in the conjunctiva such as a contraction band or pterygium. Such an eventuality may not arise in your practice, but it frequently does in ours. We do not always operate on minor degrees of pterygium before cataract extraction.

It sometimes happens that there is a pull down and in, or down and out, such as might, on completion of the section, give rise to a twisted or sliding section. This may be countered by making our bridge opposite the line of pull. With a bilateral pterygium a broad bridge upwards is best. The same principle is adopted when for any reason there are lines of stress in the conjunctiva, for example, scar tissue, which might put an uneven drag on our section.

Sliding out the heavy sclerosed types of cataract with weak or dehiscent zonules between fine iris repositors or spatulae. It is of course possible to slide these cataracts out as intracapsular extractions between iris repositors, a sort of modified expression, or remove them with the erisiphake, but the lens is very large and a large section and large pupil are necessary; since they do not mold, they come out best upper pole first.

As mentioned before, if we wish to retain such extractions as extracapsular extractions, an iridectomy, capsulotomy with toothless forceps (for instance, Kalt's), and wheeling with the needle constitute a technique which will diminish the dangers of a torn zonule and of a presentation of the vitreous which may follow the attempt at ordinary delivery. Alternatively, the nucleus may be slid out between fine flattened repositors by gentle introduction of one through the capsule opening and under the nuclear edge.

The same use is made of the fine flat spatula or fine iris repositors in sliding out a nucleus from the anterior chamber. The maneuver has already been referred

to in connection with taking out a morgagnian nucleus from the anterior chamber, ectopic lenses, and so on. It is more readily demonstrated than described.

The zonule torn below, capsule also torn. In attempting the intracapsular method with forceps not only may the zonule be torn below but the capsule may tear at the same time. This is an undesirable position. It has been mentioned before that, owing to this complication, a failed intracapsular with forceps is not the same thing as a straightforward capsulotomy. When this happens and the black gap of vitreous appears below, overriding the lower pole of the lens, the greatest difficulty may be experienced in effecting the extraction without inducing a further invasion of the anterior chamber by vitreous and without leaving behind cortex mixed with vitreous.

Elevation of the nucleus in its upper third with a needle in the left hand (a lift combined with a slight push down) may enable one to obtain a hold of the capsule, near the equator, with a Kalt forceps and effect a good head-on delivery, leaving nothing behind.

Government Ophthalmic Hospital.

NODULAR DYSTROPHY OF THE CORNEA

SIX YEARS AFTER TREATMENT WITH CORNEAL RESECTION AND RADIUM

REPORT OF A CASE

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In 1931 Dr. E. L. Goar[1] reported a case of nodular dystrophy of the cornea, including with his description sketches of the eyes and photomicrographs of excised pieces of the cornea. Subsequent to the publication of this report, a number of articles on the same subject have appeared in the literature. The consensus of opinion is that when this condition develops, its course is progressive and terminates in blindness.

Dr. Goar's patient entered the summer session of the Texas School for the Blind in June, 1929, at which time he came under our observation. We wish to present the results of six years' treatment in this case; therapy consisting of Wiener's resection of the cornea and Lane's method of applying radium. This is the only case that we have been able to find in which treatment proved beneficial for such a length of time.

CASE REPORT

C. E. B., aged 52 years, married, a brick mason, was first seen on June 20, 1929. About 19 years previously he had noticed that his vision was gradually getting worse. Occasional attacks occurred when the eyes watered and were painful to light. For the last four or five years, the vision had been so impaired that he was unable to read or do his work. Nothing is his past history was significant in regard to the ocular condition. One brother, one sister, and an uncle were afflicted in a similar manner. Mother and father were living and well.

Clinical Findings: Vision in each eye was ability to detect hand motion at two feet. (On April 27, 1927, Goar found the vision to be R.E. 10/200, L.E. 4/200.)

Both eyes were normally prominent. The extraocular movements were normal.

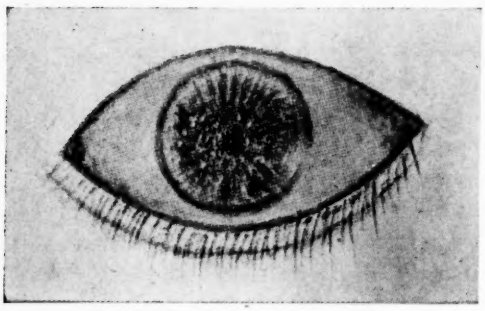

Fig. 1 (Goar). Showing appearance of cornea with the loupe and oblique illumination.

vanced than that present when Dr. Goar first saw the patient.

Left Eye: Similar to the right eye.

Treatment: On July 1, 1929, the left cornea was resected according to the method of Wiener. The postoperative course proved to be uneventful.

A 10-mg. platinum radium needle was passed over the cornea for three, four, and five minutes, respectively, on July 29th and August 6th and 13th.

The right eye was operated on in the

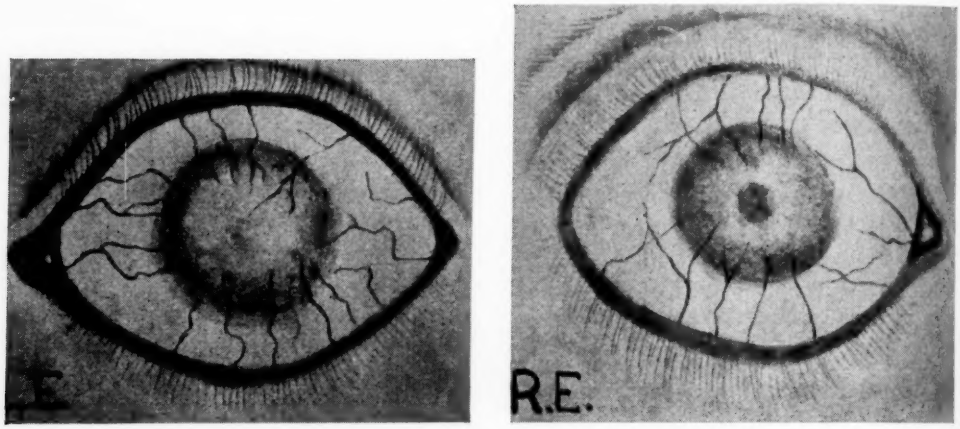

Fig. 2 (Goar). Corneas after subsidence of severe inflammatory reaction.

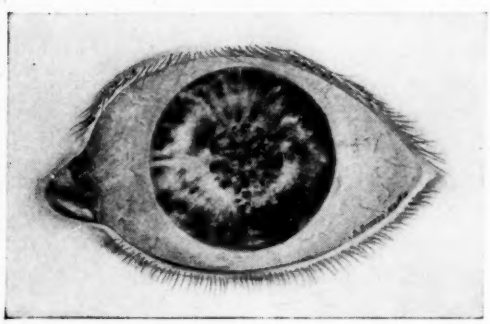

Fig. 3 (Hilgartner). Appearance of the left eye, six years after surgery and radium treatment.

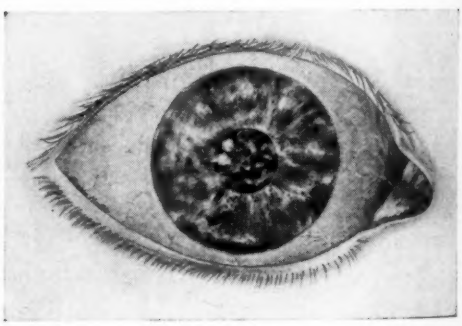

Fig. 4 (Hilgartner). Appearance of the right eye, six years after surgery and radium treatment.

Right Eye: The upper and lower palpebral conjunctiva and the sclera were normal. The cornea showed numerous dense central opacities, which were white and nodular. The details of the iris were obscured by the opaque cornea. The condition was similar to, but much more ad-

same manner as the left on August 23, 1929. Following this operation, the patient developed a sensitivity to atropin which caused a marked lid irritation. This, however, cleared up when the drug was discontinued.

The patient left the institution soon

after the second operation. When seen on July 15, 1930, his vision had improved to 2/200 in each eye. The central part of the cornea in each eye had cleared markedly, as compared with the condition in the previous year. Each eye again received 10 mg. of radium, on July 15th, 22nd, and 29th, for five minutes, respectively. The vision on the last date was R.E. 6/200 and L.E. 2/200.

The patient again left the institution and was not seen until March 15, 1931. During the intervening period he had received no treatments. On this date the vision was R.E. 4/200 and L.E. 2/200.

An iridectomy was performed on the left eye at the six-o'clock position on May 13, 1931. Vision prior to the operation was R.E. 6/200 and L.E. 2/200.

The patient did not reappear until September 30, 1935, when the vision was 6/200 in the right eye and 2/200 in the left eye. The accompanying sketch was made weeks later.

The cornea in the right eye showed a marked thinning of the central opacities. With the slitlamp it was apparent that many of the nodules had disappeared. The center of the cornea was clear. The iris and pupil were visible. The iris reacted to light normally. Paracentrally there were still many dystrophic nodules. The line of the incision of the resected area could be seen. The condition in the left eye was similar, but the opacities were denser than in the right eye. There was a clear surgical coloboma at the six o'clock position which apparently did not help the patient.

A 10-mg. platinum radium needle was administered to each eye for five minutes at this time.

Conclusion

One case of nodular dystrophy of the cornea is presented, treated with Wiener's resection of the cornea and Lane's method of radium application. The treatment used has definitely benefited this patient. It is hoped that this procedure will be applied in similar cases in order that its value may be determined.

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A CASE OF TUBERCULOUS PAPILLITIS WITH ANATOMIC FINDINGS

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A brakeman, 47 years old, consulted the Missouri Pacific Hospital Association on November 5, 1935, because of the total loss of vision in the left eye, one week previously.

No history of malignancy nor of tuberculosis in the family was obtained. The patient had been treated in the hospital of the Association thrice previously: once in 1911 for a month because of pneumonia; again on account of a perforated appendix, he was successfully operated on June 15, 1926; between April 18 and 26, 1935, he was confined in the hospital for the treatment of an acute rhinopharyngitis and an incipient bronchopneumonia. An X-ray film of the chest on April 20, 1935, showed an infiltration in the lower lobe of each lung and a moderate increase in markings throughout both lung fields, probably due to an incipient bronchopneumonia. In addition, calcified nodules were present in each hilus area. The Wassermann and Kahn tests of the blood were negative. The red cell count was 4,680,000, the white cell count 15,000 and the differential count was: rodshaped 16, segmented 58, large lymphocytes 4, small lymphocytes 15, and monocytes 6.

As regards the disorder forming the subject of the present writing, the patient stated when first seen on November 5, 1935, that he had had no trouble whatever with his eyes previous to that time. One week before, he had arisen in the morning with all sight gone and a painful inflammation present in the left eye. On examination, the vision in the right eye was found to be 20/20; that in the left eye was zero. The right eye was apparently unaffected and the ophthalmoscopic examination was negative. The left eye presented an inflamed iris with a contracted pupil and posterior synechiae inferiorly. The repeated use of a 1-percent and even of a 3-percent solution of atropine sulphate produced but little dilatation of the pupil. Viewed ophthalmoscopically, considerable cloudiness in the vitreous posteriorly obscured details in the fundus inferior to the horizontal meridian of the eye. The upper part of the optic papilla and adjacent retina appeared grayish-white and much swollen. Numerous large and small hemorrhages lay near the papilla in the upper visible portion of the retina. A complete general examination, together with nose and throat, genito-urinary, and dental examinations, was carried out in the next few days. The Wassermann and Kahn tests of the blood were again negative. The red blood cell count was 4,730,000, the white blood cell count 5400. The tonsils were enlarged and chronically infected. A low-grade chronic prostatitis was diagnosed by the specialist in that field. Under local treatment with 1-percent atropine and 5-percent dionin, the iritis gradually diminished. The ciliary injection on the eyeball disappeared. The exudate from the pupillary margin of the iris, forming posterior synechiae was absorbed. The changes in the fundus however remained unaltered and the vision zero. On November 18, 1935, the eye presented an increased intraocular tension. It was, as a result, more painful and the eye was, accordingly, removed on November 20, 1935.

The eyeball was sectioned vertically because the greatest disparity of clinical findings in the fundus existed between those portions above and below the horizontal plane of the eyeball.

Anatomic findings

The cornea presented several small facets or flattened spots on the anterior surface with thickening of the anterior epithelium, due to the presence of old removed foreign bodies. The substantia propria and anterior epithelium of the cornea were diffusely infiltrated with scanty numbers of small lymphocytes and macrophages.

The anterior chamber was free of coagulum but contained numerous pus cells and macrophages in the iris-angle inferiorly, a few on the posterior surface of the cornea, anterior surface of the iris, and diffusely scattered in the aqueous of the anterior chamber. The filtration network at the iris angle inferiorly contained numerous pus cells and macrophages. On the superior side, the iris angle was completely closed by the flat apposition of the base of the iris to the posterior surface of the cornea.

The iris was generally atrophic but the pupillary part was moderately thickened by edematous fluid. The stroma of the iris contained numerous hemorrhages and a meager diffuse infiltration with small lymphocytes, plasma cells, and macrophages. Small areas of pigmented epithelium of the iris lay on the anterior surface of the lens capsule near the pupillary margin of the iris.

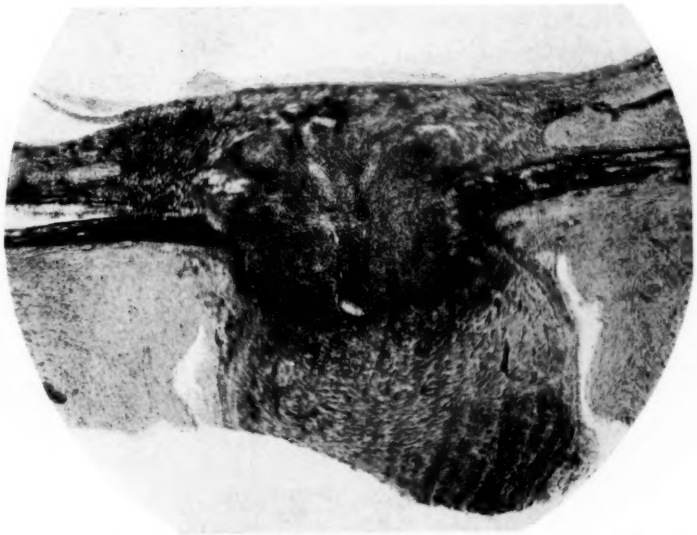

Fig. 1 (Lamb). Section through inflamed optic papilla, showing greatly increased thickness of papilla and bowing backwards of cribriform plate.

The lens showed otherwise no changes from the normal.

The ciliary body was moderately atrophic, demonstrated by the diminution in amount of the circularly and obliquely directed bundles of the ciliary muscle. A diffuse infiltration with albuminous fluid and a general congestion of blood vessels were observed in the ciliary body including the ciliary processes. Posteriorly over the orbiculus ciliaris, the unpigmented ciliary epithelium showed proliferation and cystic degeneration.

The choroid except near the optic nerve was atrophic and generally free of cellular infiltration. At the ora serrata on the inferior side, the posterior end of the

ciliary body and anterior end of the choroid were thickened by a moderately dense infiltration with small lymphocytes and plasma cells. Internally, the pigmented ciliary and retinal epithelia showed proliferation and disintegration. Infiltrating the proliferated unpigmented epithelium of the ciliary body and lying under the anterior end of the detached retina were numerous macrophages. Just behind the

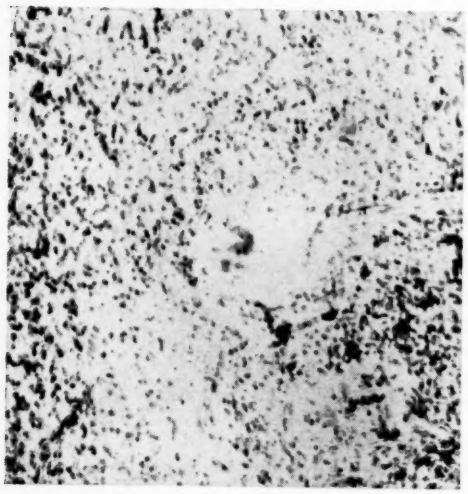

Fig. 2 (Lamb). Section through one side of inflamed optic papilla showing two giant cells lying in a large mass of epithelioid cells.

latter, under the detached retina lay a large mass of red blood cells. Generally on the inferior side and near the optic nerve on the superior side, the retina was flatly detached and under it occurred albuminous fluid, red blood cells and macrophages.

The optic papilla was the seat of the most intense inflammation. Dense infiltration with round cells had produced a very pronounced swelling of the papilla and the immediately adjacent retina. Because of this great thickening in the papilla, the cribiform plate in the optic nerve had been bowed considerably backwards as in a very deep glaucomatous cupping (fig. 1).

The infiltration in the optic papilla and adjacent retina was composed of small lymphocytes and plasma cells with several large groups of epithelioid cells and a very occasional giant cell (fig. 2). Of the collections of epithelioid cells, two lay in the papilla in about its middle, one deep to the other, and the third deep in the inflamed retina on the superior side. Necrosis or caseation was not observed in the inflamed papilla nor in the retina. Within the infiltrated tissues, the central retinal blood vessels and their branches had been largely destroyed by infiltration of their walls with small round cells. Particularly was this true in the case of the central retinal veins. Many of the small blood vessels showed proliferation of the endothelial lining cells.

The cribiform plate was infiltrated to a moderate degree with small lymphocytes. The same cells appeared in scanty numbers in the connective-tissue septa behind the cribiform plate between the bundles of optic-nerve fibers. Associated with an increased amount of connective tissue in the cribiform plate and in the septa behind it, there was present a pronounced proliferation of fibroblasts. On the superior side, the optic-nerve fibers behind the cribiform plate were not completely destroyed. The anterior end of the pia mater covering the optic nerve was infiltrated to a moderate degree with small lymphocytes and presented an increased number of adult fibroblasts. The extreme anterior end of the subdural space on the inferior side contained numerous small lymphocytes. The infiltration with small lymphocytes and the specific sclerosis as indicated by the proliferation of fibroblasts in the cribiform plate, in the septa behind it, and in the pia mater must have been due to toxins filtering back from the inflamed papilla.

The choroid above and below the optic nerve was moderately swollen by dense

infiltration with small round cells (small lymphocytes and plasma cells) for about 3 papilla diameters from the optic nerve. This cellular infiltration in the choroid was directly continuous with that in the optic papilla and was probably a derivative of the latter. At about 3 papilla diameters below the optic nerve, the choroid presented a nodule or tubercle. The latter was about one papilla diameter in width and caused a moderate degree of thickening in the choroid. Peripherally and externally, the tubercle was composed of dense numbers of small lymphocytes and plasma cells. Centrally and internally, a large core of epithelioid cells occurred. No giant cells were observed. The retinal pigment epithelium was destroyed for a considerable extent over the tubercle, whereas the lamina vitrea of the choroid remained intact. The retina, adherent to the choroid over the tubercle was almost completely necrotic over the center of the choroidal tubercle or that portion occupied by epithelioid cells. Numerous red blood cells and a few pus cells were present in the necrotic portion of the retina. In the necrotic retina, close to the lamina vitrea, lay a few very irregularly shaped multinucleated or giant cells. Staining for acid-fast bacilli in the choroidal tubercle and adjoining necrotic retina proved negative.

The retina inferior to the optic nerve generally presented a moderate degree of perivasculitis of the blood vessels. The infiltrating cells around the vessels were small lymphocytes, plasma cells, and macrophages. The blood vessels generally throughout the retina had been or were being destroyed because of the injury to their main trunks in the optic papilla. The latter would best account for the numerous retinal hemorrhages observed. These hemorrhages were both superficial and deep and in a few places inferiorly had produced small collections of red blood cells in the vitreous, adjoining the retina. On the superior side, just above the dense cellular infiltration in the retina, the latter presented an extensive destruction of its inner layers from hemorrhage.

The vitreous, anterior to the inflamed neuroretinal area, contained networks of fibrin, extending for a considerable distance anteriorly and inferiorly. The presence of this fibrin was undoubtedly the reason for the inferior part of the fundus' being practically invisible with the ophthalmoscope. Numerous macrophages, a few pus cells, and red blood cells were diffusely scattered among the networks of fibrin. Fewer numbers of the same cells were observed along the inner surface of the retina, inferiorly. Numerous macrophages and pus cells were present on the same side along the inner surface of the orbiculus ciliaris. Meager numbers of macrophages were diffusely scattered in the anterior part of the vitreous.

Discussion

Summary of anatomic findings: The retina adjoining the optic nerve was involved by the intense inflammatory process in a too limited extent to designate the process more than a papillitis. The cellular infiltration with large islands of epithelioid cells and few giant cells in the papilla and adjoining retina together with the choroidal tubercle justify the diagnosis of tuberculosis. The retinal detachment, hemorrhages, and perivasculitis were secondary to the process in the optic papilla. As has been stated, the dense cellular infiltration in the choroid surrounding the optic nerve, as well as the choroidal tubercle were most probably an extension of the process in the papilla.

A. Groenouw[1] has given the most complete review of the involvement of the optic nerve by tuberculosis. This author stated that all parts of the optic nerve can be affected with tuberculosis. Tuber-

culosis, when it causes changes visible with the ophthalmoscope, may produce tubercles on the papilla, an optic neuritis, choked disc, or an optic atrophy. On the other hand, the eyegrounds may be normal and the examination of the visual field may give a central scotoma or hemianopsia. The tuberculous character of a disease of the optic nerve only rarely permits a clinical diagnosis with certainty because of the simultaneous presence of tubercles in the choroid or upon the papilla. A probable diagnosis is made through the occurrence of other tuberculous changes in the vicinity or other parts of the body or because of a good result through treatment with tuberculin. The correct diagnosis is frequently enough first made through the examination of the enucleated eyeball. A tubercle upon the optic papilla has rarely been diagnosed with the ophthalmoscope. Instead, the picture of a complete detachment of the retina, a gray reflex from the fundus, or a severe iridocyclitis is usually observed. According to Groenouw, an optic papillitis in the absence of other tuberculous processes in the orbit, brain, or meninges is rare.

In this review of the literature, there are included only those cases of optic papillitis in which specific tuberculous tissue was found in the inflamed papilla by microscopic examination of the enucleated eyeball but in which the tuberculous process in the papilla was not an extension from a similar process in the adjacent retina, choroid, nor in the optic nerve behind the cribiform plate.

Weiss[2] in 1877 described multiple tubercles in all parts including the papilla of a single eye, previously sightless from injury in a quarry explosion, belonging to a 51-year-old laborer. The swollen papilla formed a conical mass, about 6 mm. broad at its base, projecting about 2-3 mm. into the vitreous. Microscopically, multiple tubercles with caseation composed the swollen papilla. In no other part of the body besides the eye was tuberculosis found.

Brailey[3] in 1882 reported the presence in one eye of a 27-year-old man of a mass the size of a pea arising from the region of the papilla. This mass proved to have all the histologic findings of a tubercle.

Spalding[4] in 1903 reported in an 8-year-old boy after two falls, attacks of chill, headache, vomiting, high fever with torpor, and the appearance of a yellowish tumor in the interior of the eye. Complete recovery ensued after the removal of the affected eye. Anatomically, the tumor was found to arise from the optic papilla and to fill about one third of the vitreous. Microscopically, it was composed of tuberculous tissue with much necrosis. Staining for tubercle bacilli was positive.

Knapp[5] in the same year described in an otherwise healthy negro child, 2 years old, the presence in one eye of a large tumor mass about 6 mm. broad, projecting into the vitreous at the apex of the funnel formed by the completely detached retina. This mass was found histologically to be composed of diffuse granulation tissue with many giant cells and miliary tubercles and a large central area of necrosis. Tubercle bacilli were found by special staining.

Coats[6] in 1906 reported the case of a child 16 months old dying of general tuberculosis. The left eye had been turned and the cornea dull. No view of the fundus could be obtained. The eye, enucleated at autopsy, showed a large cubical mass, 4.5 mm. broad and 3.5 mm. high, occupying the head of the optic nerve and extending anteriorly from it. The completely detached retina arose from its anterior margin. Microscopically, the mass was found to be a granuloma with a few giant cells and much caseation. The

optic nerve behind the cribiform plate was considerably involved with an extension of the tuberculous tissue. At the cribiform plate was a narrow constriction of the inflammatory process.

Verderame[7] two years later published the findings in a woman, 35 years old, previously well, whose left eye was removed because of total blindness and pain. Anatomically, a grayish-yellow tumor mass 5 mm. high and 6 mm. broad spread like a mushroom from the optic papilla anteriorly and peripherally. The histologic composition of the mass was that of tuberculous tissue with numerous giant cells and necrosis.

Komoto[8] in 1912 reported in a 10-year-old girl, otherwise healthy, a grayish-white slightly prominent tumor mass at the base of the completely detached retina. Anatomically, the tumor mass was found to occupy the papilla and its vicinity and to consist of tuberculous tissue.

Jacobs[9] also in 1912 described in a 17-year-old young man, in addition to the changes in the optic nerve, a tuberculous disease of the little finger on the left hand, a tuberculous involvement of the pharynx and larynx, and a tuberculosis of both lacrimal sacs, also of the conjunctiva in the left eye. With the ophthalmoscope, a large and very prominent grayish-white tumor mass lay at the site of the optic papilla. Anatomically, in the enucleated eye, the retina, detached near the papilla, arose from the anterior surface of the tumor. The mass extended considerably more into the vitreous on the inferior side than superiorly. Microscopically, it proved to be tuberculous with relatively few giant cells and little caseation. Inferiorly, the growth had extended into the choroid and for a considerable distance posteriorly into the optic nerve behind the cribiform plate.

It is noteworthy that of these eight cases, three (Verderame, Komoto and Jacobs) were reported from Axenfeld's clinic at Freiburg in Baden. Careful search through the literature was made up to the present time. Many other cases have been reported with the clinical diagnosis of tuberculous papillitis. In some of these, considerable improvement followed the employment of tuberculin. Nevertheless, an unquestionable diagnosis can be made only when the process is so intense as to make enucleation necessary and an anatomic examination possible.

Summary

In a man 47 years old, a railway brakeman, there occurred a very pronounced swelling of the optic papilla and much cloudiness in the vitreous anteriorly and inferiorly to the optic nerve. Superiorly, the retina contained numerous hemorrhages. No significant process elsewhere in the body could be found as an etiologic factor. Because of increased tension and pain, it became necessary to enucleate the totally blind eye. Anatomically, the greatly thickened papilla was found to be infiltrated with islands of epithelioid cells and a few giant cells, surrounded by small lymphocytes and plasma cells. In the neighboring choroid, an extension of the process from the papilla had produced a single tubercle with an involvement of the adjacent retina.

Grateful acknowledgment is hereby tendered Dr. O. B. Zeinert, Chief Surgeon of the Missouri Pacific Hospital Association, for permission to report this case.

The microscopic sections of the eye were prepared at the laboratory for ophthalmic pathology, Washington University School of Medicine.

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HEREDITARY PARALYSIS OF THE ABDUCENS NERVE*

Report of a case

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The following case is reported for the reason that it represents the comparatively rare picture of hereditary paralysis of the sixth nerve.

N. F., a white female, aged 4 years and 3 months, was brought to the dispensary of the Wilmer Ophthalmological Institute by her mother from whom the following data were obtained:

The child's left eye will not turn out.

The patient's mother, maternal grandmother, and two maternal uncles have been unable to abduct the left eye since birth. The patient's only brother has normal eyes. There is no history of other eye disease, and no tuberculosis, cancer, nor familial nervous disease of any sort.

The child's general health is good; no serious illness has intervened nor any systemic disease. Delivery at birth was normal.

Since birth the child has been unable to turn the left eye outward. There is no history of pain nor inflammation about the eyes; and no apparent visual disturbance.

Eye Examination: The child was alert and quite intelligent. Visual acuity could not be recorded accurately, but rough tests showed both eyes to be normal. The lids, lacrimal apparatus, tension, and pupillary reactions were normal. The left eye could not be rotated outward beyond the midline (fig. 1A); there was a slight outward movement up and to the left. With the gaze directed straight ahead there was no internal deviation of the left eye (fig. 1 B). Adduction was normal (fig. 1 C) with no narrowing of the palpebral fissure nor retraction of the globe. Convergence could not be tested. Extraocular movements of the right eye were normal throughout. The position of the eyes in the sockets was normal.

The grandmother and two maternal

* From the Wilmer Ophthalmological Clinic of the Johns Hopkins Hospital and University.

uncles were not available for examination, but the mother submitted herself to examination and showed a typical Duane's syndrome as described by that writer in 1905.[1] There was no abduction of the left eye in the horizontal plane (fig. 2 A), but slight outward movement when the gaze was up and out. Adduction was poor and was accompanied by a vertical deviation upward and marked narrowing of the palpebral fissure (fig. 2 C). The left globe was retracted 3 mm. when adducted. There was a manifest left static enophthalmos which measured 3 mm. with the exophthalmometer. There was no internal deviation of the left eye when the eyes were in the primary position (fig. 2 B). The mother habitually kept the head rotated to the left about 15 degrees. There was occasional slight diplopia when the gaze was turned to the right, but never when directed to the left.

Fig. 1 (Laughlin). Patient, N. F. A, looking to the left; B, eyes in primary position; C, looking to the right.

Fig. 2 (Laughlin). Mother of patient shown in figure 1. A, looking to the left; B, eyes in primary position; C, looking to the right.

Although congenital defects of abduction are of relatively frequent occurrence there have been but few cases reported in which heredity was an evident factor. H. Gifford[2] (1926), in discussing congenital abduction deficiency reported one case of his own and seven others from the literature in which there was a familial tendency. Since then two cases have been recorded which with the one described here bring the total to eleven families and thirty patients. These cases of hereditary abduction insufficiency may be summarized as follows: Gifford,[2] mother left, son bilateral; Harlan,[3] mother left, daughter bilateral; Kraus,[4] mother left, son right; Endelman,[5] mother and daughter both left; Varese,[6] one case reported, mother said to be affected same way; Gunsberg,[7] mother and son both left, of the son's daughters, one left, one bilateral; Best,[8] case of left side, maternal grandmother reported to have same condition; Wardenburg,[9] father and three children in family of eleven, all left; Lodberg,[10] sixteen-year-old girl bilateral, maternal aunt left; Zentmeyer,[11] three instances of Duane's syndrome—in child, mother, and grandmother; present case of five persons in three generations, two of whom were examined—patient, mother, maternal grandmother, and two maternal uncles, all with left involvement. Wolff[12] has also reported three siblings all with left abduction insufficiency and retraction movements. These are not included in this list, since they all occurred in the same generation.

An analysis of these cases shows the hereditary factor is not sex linked, although there is definite preponderance of females. Of the patients whose sex was reported 75 percent were females and 25 percent males. In those concerning whom the eye was reported all but one of the

unilateral cases occurred on the left side, or 95.3 percent. These figures agree with other reported series of straight congenital abduction deficiency in which heredity was not especially considered. All of these showed a majority of females and a majority of left eyes. In Gifford's series 60 percent of cases were in females, and 77 percent of the unilateral cases were in left eyes. Including the present case there are only three instances in which the abnormality appeared in more than two generations.

Gifford suggested birth injury as the etiological factor, but it does not seem likely that this would explain the occurrence in successive generations nor the preponderance of afflicted females. The subject of congenital abduction deficiency has already been discussed adequately by Duane, Gifford, Green[13] and others.

An excellent bibliography of all hereditary diseases of the eye has been composed by Clausen,[14] and the entire subject is dealt with thoroughly by Waardenburg.[15]

SUMMARY

A case of hereditary paralysis of the abducens nerve is presented, in which five members in three generations of the same family were afflicted; two were examined. Ten other cases are reported from the literature. A statistical analysis of the data shows that in this condition a majority of females and of left eyes are affected.

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KRUKENBERG'S SPINDLE*

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Since 1889, when Krukenberg first described the brown pigment deposits arranged in a vertical spindle on the posterior corneal surface, only some forty to forty-five cases have appeared in the literature and considerable speculation as to their significance has been indulged in. These so-called spindles are masses of variously sized brown pigment particles centrally located in and on the endothelium of the cornea, usually in a vertical or oblique elipse with its widest diameter below the center of the pupil. In the majority of cases there were myopic refractive errors of different degrees but some instances of this condition have been reported in hyperopic persons as well. All but four of the patients presented binocular spindles. The color of the irides usually was brown, although blue and gray irides have been mentioned. The spindles were not known to their possessors, in as much as their vision did not seem to be disturbed by the pigmented opacities.

Edgerton[1] has written an excellent thesis on the subject and since this was published there have appeared a number of shorter articles by Post,[2] Puglisi-Duranti,[3] and Caramazza.[4] Post reported two cases occurring in myopic patients. Puglisis-Duranti described two in hyperopic and one in myopic persons. Caramazza very effectively detailed the records of two patients who had small myopic errors. No observer has ever reported Krukenberg's spindle in a patient younger than twenty-two years of age.

The following five instances of Krukenberg's spindle have been studied within the past six months.

Case 1. Miss M. B., aged 37 years, gave a history of myopia since childhood. Both parents were myopic. The only serious ailments she had ever had were scrofula and a recent catarrhal otitis media. Vision was 15/200 O.U., corrected to 20/20 O.U. by O.D. —3.50 D. sph. ⌯ —1.00 D. cyl. ax. 120°, and O.S. —3.50 D. sph. ⌯ —.75 D. cyl. ax. 60°. The irides were brown and there were easily visible brown vertical spindles on each cornea. The fundi were normal. The spindles were about 4 mm. by 2 mm. in size and when examined by the slitlamp were found to be clusters of brown pigment spots in and on the endothelium of the cornea. The spindle margins were very diffuse and gradually faded out, making the actual horizontal diameter much more than 2 mm. There was no free pigment in the aqueous and the lenses were clear. In the irides were patches of superficial peppery pigment granules similar to those on the cornea.

Case 2. Mr. L.B., aged 36 years, desired an examination because of headaches. He proved to be emmetropic, vision was 20/20 O.U.; he had sinus disease, had suffered from a tuberculous arthritis of the right shoulder joint for 19 years, and left 8th-nerve deafness. Examination revealed bilateral "spindles," more conical than eliptical, the right (5 mm. vertically and 3 mm. at its base) reached the lower limbus, while the left was about one half this size. The pigment granules were in and on the corneal endothelium. The irides were brown and no other changes were noted by slitlamp study.

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*From the Department of Ophthalmology, Long Island College of Medicine. Read before the Brooklyn Ophthalmological Society, Oct., 1936.

Case 3. Mr. F. H., aged 32 years, was seen by the courtesy of Dr. Walter V. Moore. His past personal history was significant only in that he was an engineer and had worked before an electric furnace for about one year. He was moderately myopic and had 20/20 vision O.U. with O.D. —4.50 D. sph. and O.S. —4.87 D. sph. Examination resulted in two interesting findings—a bilateral arcus senilis and bilateral symmetrical Krukenberg's spindles which were central, vertical, and measured 4 mm. by 2 mm. The irides were brown. No other pigment disturbances were noted. Slitlamp study disclosed the same pigment distribution as in the previous cases.

Case 4. Mr. A.C., aged 39 years, had had facial erysipelas when 34 years old. He had never had any other ocular trouble, although his eyes were always large, buphthalmic. The vision was 20/50 O.U. and could be corrected to 20/30 O.U. by O.D. + 1.00 D. sph. ⌯ —3.00 D. cyl. ax. 15° and O.S. + 1.00 D. sph. ⌯ —3.00 D. cyl. ax. 150°. The sclerae were blue-tinged, the corneae measured 14 mm., the anterior chambers were deep. Tension, fields, blind spots and fundi were all normal. The irides were brown and on the posterior surface of each cornea were symmetrical, vertical, brown spindles about 4 mm. by 2 mm. in size. Slitlamp study showed them to have the usual diffuse margins and purely pigmented structure. There were no other pigmentary disturbances but a small central subcapsular lens opacity existed in the left eye.

Case 5. Miss H. S., aged 23 years, complaining of eyestrain, had 20/20 vision O.U. Cycloplegic examination revealed an emmetropia. The slitlamp made visible a group of brown pigment particles in and on the corneal endothelium, O.U., below the pupils and about 2 mm. by 1 mm. in size, denser in the right eye. The anterior capsule of the left lens had a number of brown star-shaped pigment clusters. The irides were also brown. The patient gave no history of any ocular inflammation nor injury; she had had no serious ailments. This case may be one of developing Krukenberg's spindles.

There are two theories as to the genesis of this clinical entity; namely, congenital and acquired. The former has the serious flaws that no case has ever been reported in a child, that no other congenital pigment disturbances occur as a rule, and that Koby[5] has directly observed the formation of the spindles in two cases. Of course, anterior-segment inflammations do not seem to give rise to this condition, nor do anterior-segment eye contusions (Davidson).[6] However, may not general toxemias disturb the peculiarly mobile ocular pigment? In two of the foregoing cases there were histories of serious ailments, such as scrofula and tubercular arthritis, and Caramazza's two patients had respectively (1) polyserositis and cold abscess of the knee and (2) scrofula and chronic pleurisy, all tubercular in origin. Myopia is predominant in this condition. Could some cases of myopia not be influenced by a toxemia, possibly tuberculous? Koby[5] and Turk[7] advanced the ingenious theory that free melanin in the aqueous is carried by convection currents to the posterior surface of the cornea and deposited on the coolest segment, which is directly in front of and just below the pupil.

More careful histories must be secured before any definite conclusions can be drawn concerning this very interesting condition.

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VISUAL SEQUELAE FROM EPIDEMIC MENINGOCOCCUS MENINGITIS*

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Published reports of complications resulting from meningococcus-meningitis infections vary greatly. Uhthoff[1] (1906) found ocular complications in about 45 percent of cases; Sinclair[2] (1919) in 14.8 percent; Slesinger[3] (1933) found visual sequelae in 9.5 percent of cases in children, and Kotliarewskaya[4] (1933) found them in 65.3 percent; Lazar[5] (1933) in 12.4 percent, VI-nerve paralysis, endopanophthalmitis. Dunphy's[6] review comments on the different parts of the eye affected in different epidemics.

Variations depend upon the form of treatment, immunity, strain of organism, site of process, standards of observations and interests, and reaction at different ages. Especially important is whether the observations were made during the acute stages of the disease and convalescence, or after presumed recovery.

This clinical study was undertaken to determine clinical residue persisting in epidemic meningococcus infection, especially relating to the visual system and to compare these with other complications—particularly aural. The average interval between acute illness and these observations was 25.9 months in 68 selected cases, and 82.68 months in 25 unselected. Average ages and sexes were computed from statistics of the Detroit epidemic of 1928-31. At the time of infection the average age was 10.6 years. General, neurological, ophthalmic, and otologic examinations* were made in 68 cases showing

TABLE 1

TABULATION OF REPORTED OCULAR COMPLICATIONS OF MENINGOCOCCUS MENINGITIS INFECTIONS

	Uhthoff 1906	Sinclair 1919	Slesinger 1933	Kotliarewskaya 1933	Lewis[7] 1933	Lazar 1933
Optic neuritis	18			2	7	
Extraocular paralysis	16	8	2	10		11
Pupil anomalies	12			14		
Conjunctivitis		2		6		
Corneal ulceration		2		1		
Metastatic ophth. and Endophthalmitis	4	7	2	3		22
Blind and normal fundi				13	3	
Optic atrophy					4	
Ages	Mixed	Mixed	Inf. to 15	Inf. to 11	Mixed	Mixed
Total cases	110	128	42	75	184	266
Percentage of eye complications reported	45.4	14.8	9.5	65.3	7.6	12.4

* General examination by Drs. John Gordon and F. H. Top; Neurological by Dr. Ward W. Harryman; Otologic by Drs. J. M. Robb and Hayden Palmer.

* From Herman Kiefer Hospital. Read before the American Academy of Ophthalmology and Otolaryngology, at New York, October 1, 1936.

a high percent of complication. An additional group of 25 unselected cases was used to compare the relation of seeing with hearing defects; average age 11.52 years; average interval 6.89 years.

The Detroit epidemic began in the spring of 1928 and reached a peak in May, 1929. The attack rate was increased from 3.1 per 100,000 population (1923-1927) to a high of 60.7 per 100,000 in 1929, with a mortality of 30 deaths per 100,000 population. The age and death distribution (1927-31) is shown in table 2.

TABLE 2

HERMAN KIEFER HOSPITAL MENINGOCOCCUS MENINGITIS, 1927–1931: CASES, DEATHS, AND CASE FATALITY, BY AGE GROUPS[8]

Age	Cases	Deaths	Deaths per 100 Cases
Under 1	44	23	52.3
1	49	24	49.0
2	54	12	22.2
3	54	18	33.3
4	61	17	27.9
5	48	13	27.1
6	37	11	29.7
7	30	9	30.0
8	30	4	13.3
9	30	8	26.7
10–14	137	38	27.7
15–19	145	53	36.6
20–29	212	91	42.9
30–39	101	53	52.5
40–49	41	22	53.7
50–59	14	9	64.3
60–	3	2	66.7
Totals	1090	407	37.3

The fatality rate for all ages was 37.3 percent. The organism was largely Type III. Specific treatment consisted of injections of meningococcus serum given by intraspinal, intravenous, and intraventricular routes and through the cisterna magna.[8] The antitoxin of Ferry[9] had not been developed.

The epidemic disease begins as a nasopharyngitis (probably at times as a conjunctivitis), and by the blood-stream route develops into a sudden, overwhelming infection as a meningococcus septicemia. The clinical complications during the early stages of the disease are those referable to the brain, cord, ear, eye, kidneys, joints (as arthritis), heart, skin, and lungs (usually lobular pneumonia).

Clinical notes during the acute phases of the disease, in the cases herein reported, mention the following complications: petechiae, herpes, abscess, serum sickness, lymphadenitis, tonsilitis and pharyngitis, conjunctivitis, arthritis, otitis media, squint, nephrosis, uveitis, exudative choroiditis, endocarditis, functional myocardial insufficiency, encephalitis, vaginitis, erysipelas, corneal ulcer, optic atrophy, and syphilis.

The ocular complications noted in the Detroit epidemic were endophthalmitis, panophthalmitis, iritis, iridocyclitis, uveitis, choroiditis, acute conjunctivitis, optic atrophy, and strabismus.

Ocular-muscle complications vary with the site of the lesion due to toxins and focus. The disastrous endophthalmitis characteristically begins early in the meningococcus infection; it is comparatively painless; slight congestion is present, and a grayish exudate, usually from the ciliary body, is seen, soon to appear in the anterior chamber. The tension is lowered. The hypopyon clears and the tension remains low, while vitreous changes persist and lead to the late chapters of "pseudo-glioma" and the blind shrunken eye. An early case reported with specimen by Mayou,[10] showed a thrombus in the ciliary body with exudation largely in this region. From a late enucleation (6 months after infection) Hayden[11] described the vitreous abscess as resulting from a septic embolus in the retina.

The following outline was used in general and neurological examinations: History, nutrition and body type; head size and shape; facial expressions; development; speech, tone, articulation, aphasia; mentality, consciousness, disposition, in-

telligence, ideas, emotions; posture, gait, station; atrophy or deformity; abnormal movements or tremor, coördination; paralysis; pupils; taste; smell; hearing; sensations, tactile, pain, motor position, vibratory, wrist and ankle, tendoachillis; biceps; triceps; knee; plantar; umbilical, upper and lower; cremasteric; cranial nerves; heart, lungs, abdomen; lymph glands; endocrine; joints; temperature; pulse, respiration; hemoglobin; white blood cells; blood pressure, and other special details and additions.

The general medical examination showed the following pathology in the selected 68 cases:

	Cases
Enlarged liver	6
Enlarged heart	4
Mitral endocarditis	1
Functional myocarditis	2
Enlarged spleen	5
Markedly enlarged suboccipital glands	1
Marked cervical-gland enlargement	1
Dyspituitarism	1

Two patients were syphilitic; neither is included in the group numbered above. Blood pressure, blood hemoglobin, and white-cell counts were made from many without unusual findings.

Neurological examinations of the complicated series (apart from eye and ear) showed the following sequelae:

	Cases
Pseudo-hypertropic muscular atrophy	1
Encephalitis	3
Hemiplegia	1
Marked vasomotor changes	2*
Tremors	2
Cerebellar ataxia	2
Sensory residue upper extremities	1
Facial palsy	1
Very unstable emotional tone	2
Disturbances in gait	4**
Personality changes	10

*1 also with markedly dilated pupils.
**Foot eversion 1, right lower leg only 1.

The last item is a comparison of the patient's reaction to his environment after meningococcus infection with that before. Excessive irritability, temper outbursts, apprehensions, juvenile fears, sadism, and other sharp differences were used to establish this group.

In the selected group of 68 cases deafness was found as follows: bilateral, 20; unilateral, 4, associated with labyrinthine disease. Hearing loss was measured by voice, fork, audiometer, and calloric tests and was found to be partial in a fair proportion of cases. A separate series of 85 cases showed: partial unilateral deafness, 7; bilateral partial, 4; complete unilateral, 5; complete bilateral, 14 examples. With a selected high percentage of deafness there was found an increase, but not a parallel increase, in ocular complications.

The ocular residue that may be ascribed to meningococcus infection listed in table 3 occurred in a total of 16.1 percent of cases; in 22 percent of the high-complication group.

Muscular disturbances seen early in the disease disappear. Other muscle findings were two convergent and one divergent squint, one left-superior-rectus defect and one loss of convergent power. The two examples of nystagmus were not constant nor in all directions of gaze, but each was a definite vertical type on upward gaze and not associated with low vision.

Pupil changes were abnormal dilatation with diminished range of reaction to light, associated with marked vasomotor disturbances in all the extremities; the other case showed persistent unequal pupils apparently acquired during the disease, the light and accommodation reactions being present. The all-or-none character of endophthalmitis make this a consistent complication both early and late in the disease. The reported cases agree fairly well in percentages. The writer has not seen a case showing the vitreous stage of exudation, in which vision was recovered. The use of Ferry antitoxin, as reported by Hoyne[12] and Lazar,[5] offers hope both

to prevent this complication and also to stop such a process under way. Because cases of pseudo-glioma without history of meningitis in which the meningococcus was recovered from enucleated eyes have been reported,[13] one must bear this agent in mind in considering etiological factors. An example of an optic neuritis, with edema on the nerve heads of over one diopter, associated with chronic photophobia, was found; and one eye with neuroretinitis, the other shrunken from endophthalmitis. The other fundus changes were not thought to be aftermaths of meningococcus.

TABLE 3

OCULAR RESIDUE FROM 95 CASES OF EPIDEMIC MENINGITIS: INTERVAL AVERAGE OF 54.29 MONTHS.

Muscles and Squint		Pupil Changes		Endophthalmitis	Fundi	
Convergent	2	Both dilated	1	O.D. 2	Optic neuritis and edema	1
L.-sup.-rectus palsy and head tilt	1	Anisocoria	1	O.S. 1	Neuro-retinitis in one eye, associated with phthisis bulbi stage of endophthalmitis	1
Nystagmus intermittent, including vertical	2			O.U. 1		
Divergent	1					
Convergent weakness	1					
Total	7		2	4		2
Percentage	7.5		2.15	4.3		2.15

SUMMARY

Medical, neurological, ophthalmic, and otologic examinations were made of 68 cases selected because of a high proportion of complications, 25.9 months after epidemic meningococcus infection. Ophthalmic and otologic examinations were made of 25 additional unselected cases 82.68 months after the epidemic. The medical examinations showed enlarged livers, spleens, and hearts in from 5.8 percent to 8.8 percent of the 68 cases; other complications persisting were comparatively infrequent. The neurological manifestations remaining after the acute disease were especially pronounced and severe in the personality field. These increased with the selected increase of other complications. The visual sequelae averaged 16.1 percent in 93 cases and were divided into muscle disturbances, 7.5 percent; pupil, 2.15 percent; endophthalmitis, 4.3 percent, and fundus changes, 2.15 percent. Many eye complications in the acute state of the disease were fugitive, but those persisting apparently had been acquired early in the disease. Acute disease is composed of causative agent with its various secondary side actions. The late or chronic disease is often a picture of the side actions alone. Loss of hearing, total and partial, was a most frequent and serious complication, and in these selected cases the visual sequelae increased but not proportionally with the auricular. The actual percentage of permanent visual-complication sequelae to the disease must vary in different epidemics and different parts of the same epidemic. Allowing for the higher proportion of complications in those cases returning to the hospital, due to their availability, the visual residue is less than 10 percent. One is led to the conclusion that most of the visual damage in this disease is done early during the overwhelming septicemia and toxemia, and that a continuing process is relatively uncommon. This is a hint for early and full therapeutic efforts. However, as shown

by Wertham,[14] deep lesions occur in the nervous parenchyma, chiefly in the cortex, but also in the subcortical structures. The neurological findings reported herein substantiate this, and suggest a continuing process.

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THE INFLUENCE OF THE VITAMIN-D—CALCIUM-PHOSPHORUS COMPLEX IN THE PRODUCTION OF OCULAR PATHOLOGY*

1. A HISTOLOGICAL STUDY OF THE CHANGES IN THE FIBROUS TUNIC

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In a previous article,[1] we reported our ocular findings in puppies receiving a diet deficient in vitamin D and low in calcium. There were observed: prominence of the eyeball, widening of the palpebral fissure, episcleral injection, primary ectasia of the cornea, deepening of the anterior chamber, and swollen, muddy iris. Lenticular opacities were followed from the incipient stage to the mature cataract. Fundus examination revealed pallor and irregularity of the nerve heads, attenuation of the retinal arteries, dispersion of the pigment of the tapetum cellulosum, and an occasional hemorrhage.

The changes observed in the eyes of these dogs on a diet deficient in vitamin D and low in calcium, resembled very closely and were often apparently identical with certain ocular diseases of man, the etiologies of which were unknown.

For our first report we studied the micropathology of the fibrous tunic, a full description of which is now given: In the cornea, it was found that the epithelial layers of cells became thinned when the dietary deficiency was advanced (fig. 1). The surface squamous layer was cornified in some of the animals (fig. 2). In one cornea was discovered a definite "dimple" of the epithelium (fig. 3). The epithelium was normal, but dipped down to fill in a

*From the Department of Pharmacology, College of Physicians and Surgeons, Columbia University.

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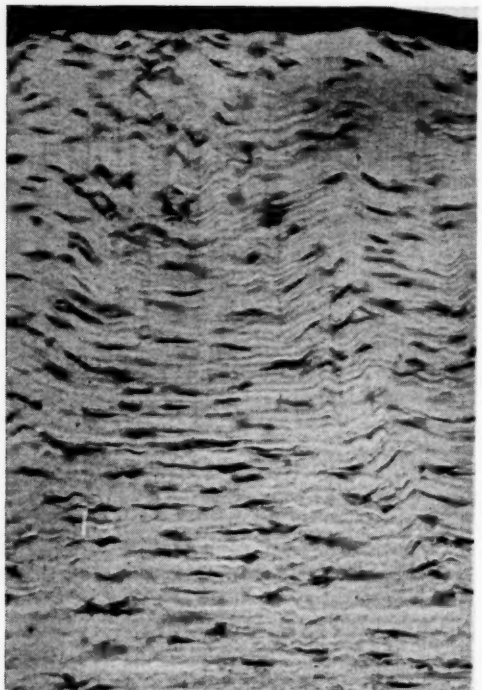

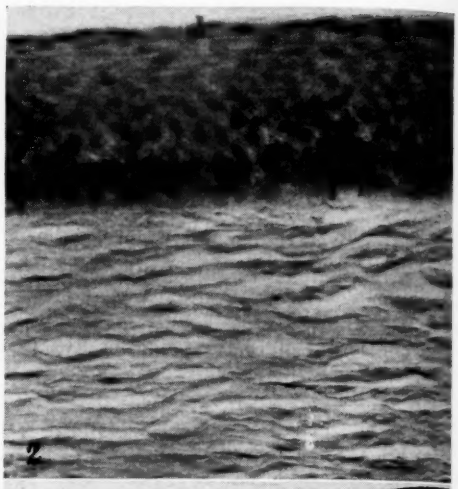

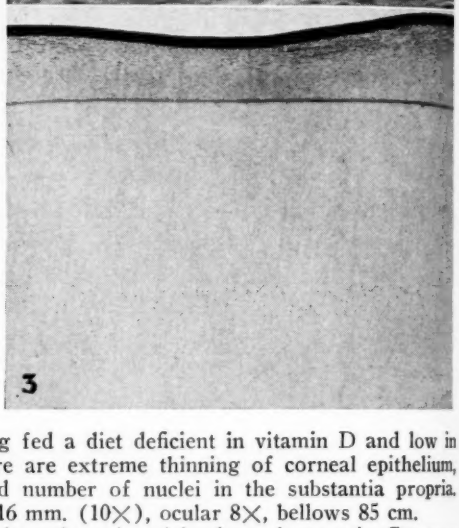

Fig. 1 (Blackberg and Knapp). Cornea of dog fed a diet deficient in vitamin D and low in calcium. Entire cornea is markedly thinned, there are extreme thinning of corneal epithelium, irregularity of lamellar structure, and an increased number of nuclei in the substantia propria. Compare with figure 2. Magnification: Objective 16 mm. (10×), ocular 8×, bellows 85 cm. irregularity of lamellar structure, and an increased number of nuclei substantia propria. Compare with figure 2. Magnification: Objective 16 mm. (10×), ocular 8×, bellows 85 cm.

Fig. 2 (Blackberg and Knapp). Cornea of dog fed a diet low in calcium with adequate vitamin D. Note marked edema of substantia propria. The surface epithelium is cornified. This condition is an earlier stage than that shown in Fig. 1. Magnification: Objective 16 mm. (10×), ocular 8×, bellows 85 cm.

Fig. 3 (Blackberg and Knapp). Cornea of dog fed a diet deficient in vitamin D and low in calcium. Dimpling of the cornea. The epithelium over the dimple is unbroken, the underlying substantia propria is thinned. Magnification: Objective 32×, no ocular, bellows 89 cm.

localized defect of the lamellar layer. The substantia propria revealed several anatomical departures from the normal. Irregularity and edema of the lamellar structure were proportional to the degree of dietary deficiency from which the animal was suffering (figs. 1 and 2). These signs were regularly more pronounced in the anterior half of the substantia propria. There was an increase in number of the corneal nuclei (fig. 1). In the posterior half of the substantia propria, pyknosis of the nuclei was evident. With the progression of this disease process, shrunken corneal nuclei made their appearance. A few wandering cells were present. There

was reduplication of the endothelium with its differentiation into two or three layers (fig. 4). Hydropic degeneration of the layer was conspicuous (fig. 4). Some dispersion of pigment could be seen over the endothelial cells.

From a consideration of these signs, one gets the picture of a degenerative process, more marked in the posterior half of the substantia propria. The increased number of cells in the anterior half suggests the presence of some irritant.

In the sclera of the animals fed the deficient diet, were found changes somewhat similar to those seen in the corresponding corneal layer—the substantia propria. Diffuse edema of the fibrous tissue caused a swelling of the sclera.

All of the animals receiving a diet deficient in vitamin D and low in calcium, manifested a primary diffuse ectasia of the cornea. Now, primary ectasia of the cornea is caused by a weakening of the corneal structures, and in our deficient animals, all of the changes point toward a weakened cornea. We think, therefore, that this dietary deficiency of the vitamin-D—calcium-phosphorus complex may be a causative agent in the development of any pathological condition due to a primary weakening of the cornea.

However, not the cornea only, but the sclera also, was weakened. Since the entire fibrous tunic gives evidence of weakening, may not this pathology, dependent upon a deficient vitamin-D—low calcium diet, be an etiological factor in myopia?

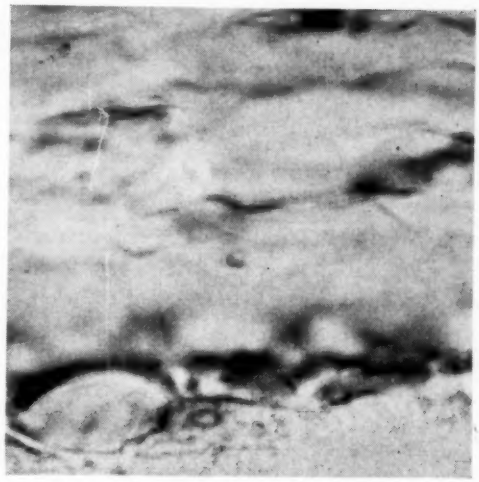

Fig. 4 (Blackberg and Knapp). Cornea of dog fed a diet deficient in vitamin D and low in calcium. Note pyknosis of nuclei in substantia propria, and hydropic degeneration of endothelial cells.

One of us (A. A. K.) is now engaged in making observations of patients with myopia and primary corneal ectasia from this point of view. Encouraging results have been obtained from the administration of medication designed to rectify the deficient diet.

We wish to thank Professors C. C. Lieb and John M. Wheeler for their kind coöperation and helpful guidance and Doctors Algernon B. Reese and G. F. Laidlaw for examining the histological preparations and corroborating our findings.

NOTES, CASES, INSTRUMENTS

AN IRIS-SEIZING FORCEPS

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The forceps portrayed in the accompanying illustration is designed to facilitate operations on the iris. Several features which have been embodied in this instrument would seem to merit attention.

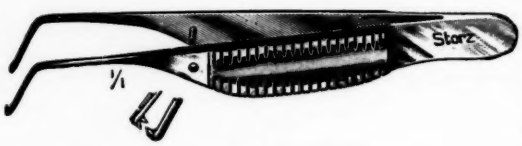

Fig. 1 (Gill). An iris-seizing forceps.

1. The forceps is of such size that it may be easily grasped without slipping in the hand, giving a greater sense of security to the operator.

2. The width of the shaft is such that the tendency to roll between the thumb and first and second fingers is minimized.

3. The length of the shaft of the forceps is shorter than in most conventional designs, which acts as a safeguard against accidental displacement of the instrument during its use, inasmuch as it does not project appreciably above the operator's fingers.

4. The spring tension is of the lightest degree compatible with stability of the blades, which enables the operator to approximate the latter with a minimum of effort.

5. The blades are arranged in parallel fashion to minimize accidental introduction of fluids into the eye, which sometimes occurs when using forceps whose blades have a triangular open space between them. It is impossible completely to overcome capillary attraction of fluids in such forceps, but it has been minimized in the design submitted herewith.

6. The grasping teeth of the forceps are arranged in such a manner that they point downward; they are not in the mid portion of the blades at their extremities. One tooth appears on one blade, two on the opposite, approximating in conventional mouse-tooth design with a length sufficient to seize the iris firmly, but short enough that no sharp points project beyond the back of the opposing teeth when the forceps is closed. The teeth are small and do not project sufficiently beyond the lower surface of the blades to penetrate through the full thickness of the iris, unless forced to do so by undue pressure downward. This disposition of the teeth on the blades will facilitate seizing the iris, and at the same time minimize the danger of dislocating the lens through a too vigorous downward pressure in grasping the iris of patients whose zonules are frail.

The type of forceps illustrated has been used by the author for a period of three years with complete satisfaction.

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CROSS-CYLINDER TESTS

A SUGGESTION IN TECHNIQUE AT THE TRIAL CASE

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For the principles and methods of using the most important single means we have for measuring the refraction of the eyes (E. Jackson), that is, the cross cylinder, the reader is referred to papers listed below by Dr. W. H. Crisp, Dr. Edward Jackson and Dr. H. Rommel Hildreth.

In the cross-cylinder tests it is imperative that the cross cyclinder be placed accurately in front of the test cylinder. In testing for strength, the axis of the cross

cylinder must be parallel with the axis of the test cyclinder, while in testing for axis, each of the cross-cylinder axes must be 45 degrees from the axis of the test cylinder.

The ordinary marking of the cross cylinder renders its accurate placing slow and difficult (except in the 90-degree to 180-degree and 45-degree to 135-degree axes), for in viewing the accurately placed cross cylinder from the side as one does in standing or sitting at the patient's side while refracting, the axis mark on the cross cylinder does not appear to be directly in front of the axis of the test cylinder or the axis of the trial frame, even though it is. Furthermore, the amount of this apparent inaccuracy varies in the different positions of the cross cylinder, so that one cannot estimate it perfectly. In other words, when one is at the patient's side and places the cross cylinder so that it appears to be in the correct position, it may actually be out of line several degrees. Also, it is a great deal of trouble to move one's head directly in front of the patient to make sure that the cross cylinder is accurately placed, and then, too, the hand may not hold the position while the head is moved back out of the patient's line of vision.

To remedy this difficulty, the marking of the cross cylinder shown in figure 1 is suggested. The marks are 15 degrees apart, and only those portrayed in the figure are needed. (If the plus axis and the axis parallel with the handle are marked in white, the minus axis in red, and the others in black, all axes will stand out well.)

The ophthalmologist sits or stands at the side of the patient so that his eyes are on the same level with those of the patient. The cross cylinder is placed in its approximate primary position, and then easily, quickly, and accurately adjusted, by observing only the markings on the cross cylinder that are then horizontal, and adjusting them to be parallel with the 180-degree axis of the trial frame. Here, apparent displacement due to the ophthalmologist's sitting at one side, makes no difference, for the horizontal marks on the cross cylinder will be

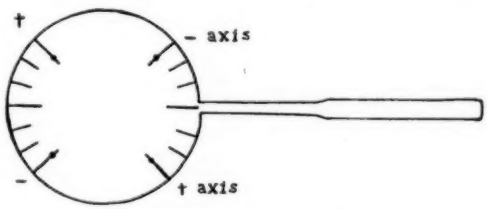

Fig. 1 (Mills). Cross cylinder.

either partially superimposed upon, or a continuation of, the 180-degree axis marks on the trial frame. Thus every position of the cross cylinder in front of the trial cylinder is accurately made by watching only the 180-degree axis. For example, the trial cylinder is at 60 degrees and one wishes to make a test for axis. Instead of being careful that the handle of the cross cylinder is at 150 degrees while one axis of the cross cylinder is at 105 degrees and the other at 15 degrees on the trial frame, it is necessary only to place the cross cylinder in its approximate position and then match the horizontal lines on the cross cylinder with those of the trial frame.

Axes midway between the major 15-degree markings of the trial frame, as, for example 67½ degrees, are easily and accurately tested by placing the cross cylinder in its approximate position and then noting that the 180-degree axis of the trial frame bisects, on each side, the 15-degree angles of the cross cylinder.

By estimating the position of only two axes, that is, the 5-degree and 175-degree, all axes that are multiples of five may be tested, or one may place short 5-degree lines between the 15-degree marks on the cross cylinder, to be matched with the

180-degree axis of the trial frame.

Also, if necessary, one can be more sure that the "flop" of the cross cylinder has been perfectly executed by making the described observations.

McAlester Clinic.

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CHALAZION RETRACTOR

WILLIAM J. HARRISON, M.D.

Philadelphia

In the operation for chalazion by means of skin incision one is sometimes hampered by troublesome bleeding. This together with a small operative field makes dissection difficult. With this in mind I have devised a spring retractor armed with teeth on either side which affords a maximum operative area and at the same time controls bleeding. The mass can be readily outlined and a careful dissection made. The instrument is offered in three

Fig. 1 (Harrison). Chalazion retractor.

sizes by George F. Pilling & Son Company, of Philadelphia.

135 South Seventeenth Street.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

April 16, 1936

Dr. Charles R. Heed, *chairman*

Marginal degeneration of the cornea with prolapse of the iris

Dr. William Zentmayer reported the case of Mrs. C. F., aged 52 years. The patient was born in Russia and came to America 14 years ago. There was a history of inflamed eyes during childhood. In 1930 she was under treatment for hyperthyroidism. The same year Dr. M. E. Smukler performed a multiple ignipuncture operation on the lower lid of the left eye for entropion and trichiasis. At about the time Dr. Smukler first saw her she had consulted a druggist because of a foreign body in the right eye, who in removing it noticed the prolapse of the iris. There was trichiasis of the left lower lid and slight ptosis of the right upper lid. On both sides the superior-lid sulcus was very deep so that a large part of the upper surface of the eyeball was covered by the lid. In both eyes marginal dystrophy of the entire circumference of the cornea was apparent. The resulting furrow was of uneven depth. In the right eye a prolapse of the iris had occurred, about 3 mm. in diameter through the floor of the furrow. The protruding iris tissue was covered by the epithelium. The sensibility of the cornea was subnormal. The epithelium was intact as evidenced by the absence of staining with fluorescein. The tension of the right eye was 22 and of the left 20 mm. Hg.

As the corneal image of the slitlamp was swept across the limbus it became constricted over the grooved portion. The constriction was particularly marked at the upper margin, where a deep groove was apparent reaching well into the substantia propria. The epithelium was intact. The limbal vascular loops extended farther into the cornea than normally. It was impossible to determine whether the endothelium was intact in the involved portion of the cornea, but it was normal in the surrounding area. No folds were visible in Descemet's membrane. There were disseminated areas of thinning of the uveal pigment in the zone of the spincter. The lens was normal.

Discussion. Dr. Alfred Cowan said that the slitlamp picture of the type of marginal dystrophy shown here by Dr. Zentmayer corresponds to the microscopic findings, inasmuch as it seems that the condition is due to a loss of cornea proper, leaving both the epithelial and endothelial surfaces intact, so that when seen it is a gutterlike depression of the anterior surface while the posterior surface remains intact. At the portion where the iris is prolapsed it is hard to tell with the slitlamp whether we are dealing with an epithelialized iris surface or whether the iris is covered with intact Descemet's membrane; but it seems that it is the iris surface and not Descemet's membrane which is seen over the hernia. It is easy to see in an ordinary descemetocele that the cornea is lost down to Descemet's membrane, but in this case since the substantia propria was absent in the neighborhood of the ectasia the anterior and posterior surfaces of the cornea became narrower toward the edge of the prolapsed iris. In those cases of corneal abscess in which the entire cornea sloughs off leaving the iris bare, the surface of

the iris becomes epithelialized in a very short time and resembles the condition here under discussion. However, in two cases mentioned by Koby, one of his own and one of Trantas, in each of which there was an ectasia of the cornea, Descemet's membrane, from the description, seems to have remained intact in one and become perforated in the other.

Complete reattachment of the retina following operation with the thermophore

Dr. Andrew Knox, by invitation of Dr. H. M. Langdon, presented the case of Mr. W. L., aged 52 years, who entered the Episcopal Hospital on January 27, 1936, with a large detachment of the retina extending from the 9 to the 2 o'clock position. At operation, by Dr. Langdon, the sclera was pierced on either side of the superior-rectus muscle with a von Graefe knife, thus allowing the subretinal fluid to exude. The thermophore was then applied seven times at different points on the sclera corresponding to the area of detachment. The temperature of the thermophore was 168° and was applied to the sclera for one minute at each application. The conjunctiva was replaced, sutured, and the patient returned to the ward. After 48 hours the eye was dressed and carefully examined. There was a small amount of edema of the lids and conjunctiva. Examination with the ophthalmoscope showed the retina to be completely reattached. Fields roughly taken seemed to be full. The patient was confined to bed for three weeks following the operation. Fields were again taken at the end of this time and showed practically a complete recovery. The vision was 20/40 with correction.

Discussion. Dr. H. Maxwell Langdon said that the procedure is very simple. One great advantage is that it does not disturb the eye and one can proceed with other operations, if necessary. That it works has been proved by the three cases he had shown here.

Tuberculin testing in ophthalmological cases

Dr. George P. Meyer, by invitation of Dr. Francis H. Adler, said that in the study of ocular tuberculosis, a properly performed intracutaneous-tuberculin test is of great assistance. It is important to observe certain precautions in the technique in performing the test and to use a potent old tuberculin or preferably purified protein derivative (P.P.D.). The latter product has the advantage of being stable and uniformly potent in its commercial tablet form. A positive Mantoux test indicates a previous tuberculous infection. It indicates that the patient is hypersensitive. It does not indicate the presence or lack of activity in the lesion. The degree of hypersensitivity does not parallel the degree of immunity. A study is being made to determine if cases of ocular tuberculosis manifest a higher degree of sensitivity than the nontuberculous.

Interpretation of cases of uveal tuberculosis and experimental tuberculous allergy

Dr. Francis H. Adler read a paper on this subject which will be published in the Archives of Ophthalmology.

Histopathology of experimental tuberculous allergy of the choroid

Dr. Esmond R. Long, by invitation of Dr. Francis H. Adler, stated that previous experiments have shown that the cornea in tuberculous guinea pigs is exquisitely sensitive to tuberculin. In the present experiments the effects of instillation of tuberculin in the uveal tract were studied. The Purified Protein Derivative of

tuberculin (Seibert) was used. Up to the present, in these experiments, efforts have been largely directed toward determining minimal doses effective in inducing allergic reactions in the choroid. A dose of 0.000005 mg. P.P.D. proved too small to produce cellular inflammatory reactions visible at the end of four days, although in a number of cases a cellular protein exudate between the choroid coat and retina, not present in the control animals, followed the introduction of this dose in sensitive guinea pigs. Somewhat higher doses were likewise ineffective in producing the well-known type of cellular inflammation occurring in the skin and cornea of tuberculous guinea pigs on suitable injection. On the other hand, an intense cellular inflammation of the choroid followed the subscleral injection of 0.01 mg. of the Purified Protein Derivative of tuberculin in sensitive guinea pigs. The choroid three days after injection was distended to five times normal thickness as a result of infiltration by polymorphonuclear leucocytes and monocytes. Evidence from other experiments suggests that the initial infiltration was with the former, and that a rapid replacement by the latter was occurring at three days. In an effort to simulate tuberculosis of the choroid without the use of tubercle bacilli, experiments are in progress in which purified phosphatide from the tubercle bacillus, with and without the Purified Protein Derivative of tuberculin, is instilled subsclerally. Definite tubercle-like nodules, tending to become absorbed in 16 days, have been produced by this method in a number of experiments.

Discussion. Dr. ESMOND R. LONG said that the conditions modifying the intensity of the tuberculin reaction are not all known. In the course of a long period the level of sensitivity may change for several reasons. The most intense reactions seem to occur in healthy people in close and continued contact with open tuberculosis; that is, in people who are resisting repeated infection. Hence changes in the intensity of exposure may modify the intensity of sensitivity. Altogether apart from this, irregular seasonal variations in the strength of the tuberculin reaction have been observed when the same person is tested at intervals for a year or more. Certain changes occur regularly in patients with tuberculosis. If the course is progressively downward the reaction tends to become weaker. It may be added that standard tuberculin of constant strength is a necessity in determining these variations in sensitivity.

Dr. Francis H. Adler said that Dr. Langdon's interesting observation confirms the fact that these tuberculous, allergic lesions have nothing characteristic about them. They do not differ in any respect from other acute inflammatory lesions of the choroid. This also serves to prove the point that one can never deduce the cause of a lesion in the eye from the fact that it disappears when some focus of infection is removed, as these allergic lesions clear up rapidly of themselves.

A. G. Fewell,
Clerk.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

October 26, 1936

DR. WILLIAM A. BOYCE, *president*

PRESENTATION OF CASES OF OPHTHALMIC STAFF OF LOS ANGELES COUNTY GENERAL HOSPITAL

DRS. REYNOLDS and GINSBERG, residents in ophthalmology, presented the following cases which were discussed by members of the attending staff.

Congenital bilateral ptosis with normal superior recti

Two cases of this condition were presented, one in a boy of twelve years and the other in a girl of thirteen. The girl had undergone bilateral Hess operations seven years ago but showed no improvement. This time Dr. Boyce had performed a Motais operation on the left eye and Dr. Trainor had made his tarsal-plate margin transplant on the right eye, both with equally good results.

The boy had been operated on eight years previously by a type of operation which could not be determined. A bilateral Motais operation was successfully performed in June by Dr. Boyce.

Cicatricial ectropion

A case of cicatricial ectropion of the left lower lid resulting from a burn in 1923 was presented. The lower lid was completely everted, the conjunctiva inflamed and hypertrophic. The punctum was obliterated. This patient was operated on in November, 1935, by Dr. Harold F. Whalman, a graft being taken from the right upper lid. The lower lid was prepared by an incision along the skin of the lid margin three millimeters below the edge and carried down along the surface of the orbicularis muscle to the orbital ridge. All scar tissue was removed. A tarsorrhaphy was performed between the lower and upper lids and the transplant laid into the denuded area from which the cicatrix had been removed, and then was sewed in with many interrupted sutures of fine black silk. A pressure bandage was then applied and allowed to remain on for seven days. At a later date the canaliculus of the lower lid was reopened and drainage established. Silver-nitrate treatments were used to reduce the conjunctival hypertrophy and the end result one year later is excellent as far as fit and function of the lid and lacrimal apparatus are concerned.

Keratodermia blennorrhagia with corneal involvement

This patient had had a gonorrheal urethritis eleven years previously, which had given him no further trouble until September, 1936, at which time he complained of pain and discharge in both eyes. Consecutive smears from the eyes were negative for organisms. Three days after the eye complaint the patient developed pain in his knee, wrist, and feet, and also a skin lesion on the right knee. Four days subsequent to this he developed bilateral corneal opacities situated in the six-o'clock position, two millimeters from the limbus, approximately two by three millimeters in size, and involving the deeper layers of the cornea. The edges of the opacity also showed some superficial involvement and stained with fluorescein. Dr. Ginsberg explained that this was a very rare condition and from a dermatological aspect was very chronic and resistant to treatment.

Sympathetic ophthalmia

Two cases of sympathetic ophthalmia were presented. One was in a boy aged 14 years, who had suffered a laceration of the cornea and sclera, exposing the ciliary body. The eye was repaired with a conjunctival flap, but three weeks later the eye was removed because of a poor result. One month after enucleation the fellow eye became red and irritated, there were cells in the aqueous, precipitates on the posterior surface of the cornea, and a beginning iridocyclitis.

The other patient was a man, 33 years of age, who had had an injury causing rupture of the sclera and collapse of the eyeball. An evisceration was performed

two weeks later. One month after evisceration the fellow eye developed cells in the aqueous, precipitates on the cornea, and iridocyclitis .Thus in these two cases sympathetic ophthalmia came on one month after total enucleation and one month after total evisceration. This very disconcerting situation proves how difficult it is to make the decision as to how long one should wait before enucleating an injured eye. It was pointed out that sympathetic ophthalmia develops in only two percent of the cases of severe laceration of the eyeball, and yet the result in these two percent is so serious as to make one hesitate to justify the attempt to save the other ninety-eight percent of injured eyes.

VITREOUS LOSS IN CATARACT EXTRACTION

Two cases of bilateral senile cataract were presented, in each of which one lens had been extracted with massive loss of watery vitreous. In both instances the lens was delivered with a loop and the conjunctival flap sewed with five black silk sutures to bring the wound edges into good apposition. Both patients had been operated on eleven months ago; one had 20/30 vision at the present time and the other 20/40. These cases were discussed by Dr. Whalman, who had performed the operations. It was his opinion that loss of watery vitreous is much less serious than loss of normal vitreous, inasmuch as the former is replaced by aqueous similar in character to the vitreous lost, and therefore of little consequence. Escape of normal vitreous, however, favors incarceration of the pillars of the iris and contraction of the sphincter, and is frequently followed by secondary glaucoma. It was his opinion that although such eyes may eventually undergo degenerative changes we are justified in operating, because the patient may be afforded some vision at least for the remainder of his days.

Harold F. Whalman,
Recorder.

ROYAL SOCIETY OF MEDICINE, LONDON

SECTION OF OPHTHALMOLOGY

October 9, 1936

MR. W. H. MCMULLEN, *president*

THE CAUSES AND TREATMENT OF POST-OPERATIVE DISTRESS FOLLOWING OPERATIONS FOR SENILE CATARACT

MR. W. H. MCMULLEN explained that he does not include the distress following surgical complications, and said that probably all ophthalmic surgeons have been told by patients after convalescence that the actual operation was not so unpleasant as they had expected it would be, but that the ensuing few days were very trying, so much so that they would be unwilling to submit to a second operation should it be deemed necessary. This distress following operation on the eyes is, he said, partly physical, partly mental, these two factors interacting on each other.

First, with regard to the physical distress, apart from the slight pain in the eye, the most distressing physical symptoms are pain in the back and abdominal discomfort, the latter usually associated with flatulence. Pain in the back is often severe, and occurs in most patients who are kept lying motionless on the back for long periods, the head supported with a low pillow—an unaccustomed posture for most people. In this position, the musculature of the back is subjected to unusual stresses, especially if the bed is fitted with a chain-spring mattress covered by an unyielding overlay. The sagging of such a mattress into a hammocklike shape causes

hyperextension of the knees, with increasing discomfort. Probably the perfect stillness commonly enjoined on the patient aggravates the effect of unaccustomed stresses; it is also likely that many patients, in their effort to keep quite still in an uncomfortable position, fail to relax properly, and so the unconscious contraction of some of the back muscles may lead to cramp, this, of course, producing discomfort and pain.

With regard to the abdominal distress, he finds it difficult to explain why eye patients should suffer in this way. Little seems to be known concerning the actual causes of flatulence. Mr. Victor Bonney discussed the subject at length in his Bradshaw Lecture two years ago on "Functional derangements of the intestine that follow abdominal operations." Mr. Bonney dealt with cases of more severe pain in the abdomen than usually follows ophthalmic operations, but the lecture contains a valuable summary of the facts then known as to the origin and disposal of gases in the digestive tract. Further light was shed at a meeting of the Section of Medicine at the Oxford meeting of the British Medical Association in July, 1936, at which it was shown that the gases in the digestive tract appear to be derived from three sources: (1) swallowed air, (2) gases diffused from the blood, (3) gases formed by chemical changes in the contents of stomach and intestines. A considerable quantity of air is normally taken into the stomach in swallowing food. Mr. Bonney mentioned in his lecture, experiments, carried out by Douglas MacLeod and Kremer, which confirmed the statement as to the large amount of air taken into the stomach by swallowing food, and showed, in addition, that the amount of air so ingested is greatest when the patient is lying down. T. C. Hunt has shown by skiagrams that a bubble of air accompanies a bolus of opaque meal in the esophagus. It has also been mentioned, by Ryle and others, that aerophagy often occurs in states of anxiety or emotional disturbances, quite apart from actual hysteria. Anxiety and emotional tension are common in patients who have undergone an operation on the eye. It is not properly known what the contribution to this discomfort caused by chemical action is. Such gases as methane and sulphuretted hydrogen, when present, must result from chemical action, but their presence is only occasional. A diet with a heavy starch constituent, given to a patient whose digestion is not robust, must help to produce painful distension. Peristalsis moves gases on and assists in their elimination from the body, but in a patient lying still in bed the activity of the peristalsis is much diminished. A colleague noted that when making X-ray examinations after an opaque meal it is necessary to allow patients to get up and walk about, in order to avert misleading results and interpretations from the skiagram. It is possible to minimize this trouble by allowing the patient to be propped up in bed at an early stage, and to be turned on his side and draw up his knees.

With regard to mental distress following ophthalmic operations, it is natural for any but the most phlegmatic patient to feel great anxiety about himself after such an event as an operation on the eye. Despite the assurance by the surgeon that all is going well, some time must elapse before it is possible to state positively that good sight will be restored. The amount and degree of the postoperative distress depend considerably upon the preoperative handling of the patient, and Ballantyne advocated keeping the patient as active as possible before the operation, encouraging the preservation of his usual interests and social contacts, the surgeon at the same time assuring him that there would be practically no pain at the operation, and that the only disconcerting

feature would be the irksomeness of a few days of rest in bed, to mitigate which everything possible would be done.

With all this Mr. McMullen fully agreed. A mild hypnotic the night before the day of operation, by ensuring good sleep, puts the patient into good form for the operative procedure. He does not favor a sedative on the day of operation, for he believes that patients behave better when they are thoroughly alert. The operation should be completed without haste, but with as much speed as is consistent with safety. If the operation can be completed while the patient is under the impression that the surgeon is engaged on the preliminaries, it is a great gain in the saving of acute anxiety.

Apart from the anxiety inevitable during the first few days after operation, the two chief causes of mental distress are the immobility of the body which is commonly insisted upon, and the wearing of the binocular bandage. The insistence on rigid immobility certainly aggravates the mental strain, for the patient is continually concerned lest some slight inadvertent movement might imperil the success of the operation. Frequently he has found a patient very gloomy in the morning because he feared he had made a slight movement during the night and so had spoiled his chance of recovery. So important has this immobility been considered in the past that severe forms of physical restraint were employed, such as fixation of head and limbs by means of sandbags.

It therefore becomes important to consider whether the two chief causes of postoperative distress, the maintenance of prolonged immobility in the supine posture, and the wearing of a binocular bandage are necessary, and, if so, to what extent.

Direct injury to the eye has often been caused by the patient's getting his finger beneath the dressing and rubbing the eye. This risk is still present when the patient is on his back, unless the hands are tied. Some patients are able to get beneath even a well-fitting shield, and a restless patient may shift the shield in such a way that the eye is pressed upon by it. The best safeguard, he considered, is a watchful nurse by the bedside.

With reference to the factor of increased intraocular hemorrhage, the cause of this is obscure, but, apart from direct injury, he knows of no cause that could be influenced by the system of nursing other than a rise of pressure in the intraocular vessels. Of the importance of preventing any sudden increase of that pressure, therefore, there can be no question. In 1912 Leonard Hill showed how easily intraocular hemorrhage occurs in a cat's eye, by exerting pressure on the abdomen after aqueous had been allowed to escape. Hence the importance of avoiding in patients any sudden abdominal contraction, such as in coughing, sneezing, straining at stool, or sitting up unaided. A cardiologist once told him that he considers the best posture for keeping the intraocular blood pressure as low as possible to be the semirecumbent one; also that only negligible changes follow movement of the limbs, or turning on the side in bed.

It thus seems clear that there is a theoretical absence of justification for keeping these patients immobile on the back for a considerable period after cataract extraction. As to the teachings of practical experience, for a number of years a few ophthalmic surgeons have been questioning the value of the traditional system of nursing: some, indeed, have refrained from insisting that their patients keep to their bed after the operation. One ophthalmologist of the older school performed the operation in his consulting room and allowed the patients to walk home after its completion, and his results were said to have been very good. More than thirty years ago William Lang

had told Mr. McMullen that he allowed his patients to sit up in an armchair on the day following the cataract extraction. In the ophthalmic hospital at which the speaker was house-surgeon 35 years ago, most of the patients walked back to the wards from the theater after the procedure, though this necessitated the negotiation of flights of stairs, and no ill-effects were observed in consequence. Once back in bed, however, the immobility ritual was strictly imposed. The adoption of this less rigid procedure seems to be gaining ground, both in this country and abroad.

In private practice he has for many years been adopting a less severe routine than the usual, and recently has been extending a like easier time to hospital patients. If a patient is comfortable and free from pulmonary symptoms he prefers to keep him in bed two or three days. If, however, the patient has a cough, or chest trouble threatens, or even if bed is found by him to be irksome, he is allowed to be assisted into an armchair on the day following the operation. Should retention of urine occur, the patient is allowed to be assisted into a sitting posture on the edge of the bed, as that sometimes helps the voiding of urine, and so cathetrization is rendered unnecessary.

There is considerable difference of opinion among ophthalmic surgeons concerning the need of a binocular bandage. Some advocate the so-called open treatment; that is, either using no covering at all, or only a thin layer of gauze that rests over the eye, or a shield without any dressing. Enquiries which Mr. McMullen has made at home and abroad, however, show that in most clinics a binocular dressing is applied, and retained for from one to four days. Should mental derangement occur, one eye must, of course, at once be uncovered. In the presence of conjunctivitis, double flaps are used instead of pads. He is doubtful as to the advisability of applying a monocular dressing for several days after the binocular dressing is discontinued. It does not keep the eye at rest, and movement of the eye under even light pressure may prove irritating. It is better at this stage to wear well-fitted dark goggles for the day, and a protective shield at night.

(Reported by H. Dickinson).

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

May 23, 1936

Dr. James J. Regan, *presiding*

Influences of size differences of the ocular images on the horopter

Dr. Werner Hersau discussed in his paper three types of size differences: (1) Physiological differences correlated with asymmetrical convergence; (2) Artificial differences induced by glasses of different magnifications; (3) Pathological differences which occur in aniseikonia.

Changes in the relative sizes of the ocular images with asymmetrical convergence

Professor Kenneth N. Ogle's paper was a preliminary report. Evidence was presented from several types of experiments on the haploscope which established the existence of some type of mechanism that compensated for retinal-image size differences introduced when looking to the right and left at near visual distances; for example, in reading. The experiments showed nearly complete compensation in the vertical meridian and a partial compensation in the horizontal meridian. These results tend to explain the fact that the size differences introduced by asymmetrical convergence do not interfere with reading.

Application of the afterimage in the investigation of squint

Professor A. Bielschowsky said that in most cases of strabismus double images cannot be elicited even after chromatic differentiation. If a dark-red glass or a Maddox rod put before the fixating eye fails to produce diplopia, it will appear if, in addition to the red glass, a prism of 15 degrees or 20 degrees is applied, displacing the retinal images of the squinting eye in any direction. A minority of the patients will now notice double images, the position of which relative to each other corresponds to the objective angle of squint plus the deviating effect of the prism. A patient with a convergent squint of 20 degrees, with a prism of 20 degrees placed base out in front of the squinting eye and a dark-red glass before the other eye, would, for instance, see homonymous double images with a separation of 10 degrees. In most cases, however, the double images will only show the deviating effect of the prisms as they would in a case with binocular single vision if that prism were to be applied in the same position. In a case of divergent squint of 20 degrees, with a prism of 20 degrees base out before one eye the double images would be crossed, their separation being approximately 10 degrees. Such a behavior seems to indicate that a new sensorial relationship between the two eyes has been developed which is adapted to the angle of squint.

The afterimage test may be of service in the diagnosis of such anomalies. By means of this one eye perceives a vertical, the other a horizontal afterimage of a line. In the presence of normal correspondence there will then appear binocularly the image of a luminous cross, while with anomalous correspondence the two lines will appear a certain distance from each other, depending upon the angle of squint. The determination of the type of correspondence is of great importance in the prognosis in determining the prospects for the successful outcome of a squint operation.

The occurrence of anomalous correspondence cannot be used as an argument against the hypothesis of an innate and constant relationship of the retinae, since there is involved only a slight association capable of involution.

Clinical aspects of aniseikonia

Dr. E. H. Carleton evaluated the correction of aniseikonia from the clinical point of view by discussing a statistical summary of three hundred cases which had obtained relief through iseikonic prescriptions given by the Eye Clinic at Hanover. He showed, that in 47 percent, or nearly one half of the cases, there had been no significant change in the refractive correction (less than 0.37 D.), while in only 23 percent of the cases the refractive errors were small (less than 1.00 D. in the maximum meridian). Ten cases of emmetropia exhibiting aniseikonia were found. With reference to the relationship of anisometropia to aniseikonia, it was stated that 15 percent of the total cases were isometropic, while in 20 percent of the cases the condition of aniseikonia was opposite to what would be expected from the condition of anisometropia. Dr. Carleton stated that he believed a large percentage of patients with anisometropia should wear iseikonic corrections. He concluded that the clinical results so far obtained warranted the statement that aniseikonia is an important factor in binocular vision and a clinical investigation of this anomaly should be made in all cases of functional disturbances of binocular vision, as well as in patients who have failed to get relief by the correction of their refractive errors.

Trygve Gundersen,
Recorder.

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ARCHIVES D'OPHTALMOLOGIE

One of the important European fountains of reference literature in ophthalmology, for a half century past, has been the "Revue Générale d'Ophtalmologie." Created in 1882, by Henri Dor and Meyer, this publication somewhat antedated the foundation of the Société Française d'Ophtalmologie. While including a few original articles or reviews, the Revue Générale devoted itself chiefly to the monthly provision of classified abstracts and a bibliography of the world's ophthalmic literature. Later editors of this magazine were E. Rollet, Truc, Louis Dor, Gourfein, Bujadoux, and Jacques Rollet.

The World War made necessary a transfer of the place of publication of the Revue Générale from Lyon to Geneva. Presumably because of the financial difficulties usually experienced by such publications, there have been one or two periods of suspended animation, and the abstracting has for the most part been decidedly tardy in relation to the dates of publication of original articles.

One of the best-known French journals devoted to publication of original articles on ophthalmology is "Archives d'Ophtalmologie." The celebrated French medical publishing house, Masson et Compagnie of Paris, recently made the important announcement that the "Archives" and the Revue Générale d'Ophtalmologie would be combined as a single monthly publication.

The new series begins with the issue for January, 1937. Of its approximately

100 excellently printed pages, 44 are devoted to well-illustrated original articles, and between 40 and 50 to abstracts from the literature. It is to be hoped that at the end of each volume the publishers will find it convenient to furnish a satisfactory alphabetical index.

In the primitive development of humanity, important discoveries must often have been utilized in one part of the world for centuries or even millenniums before they entered the lives of remote tribes or races. In modern civilization such a situation is impossible. The contrast has been created basically by what we know as written language, but more specifically by that form of written language constituted by the modern printing press, supplemented by the marvelous facilities of modern communication.

In medical practice, the acquisition of knowledge as to new methods used to depend largely upon those adventurous or enterprising spirits who traveled to foreign clinics and brought home accounts of their experiences. Today, in every civilized country, there are medical journals in which such information is more or less faithfully and effectively set forth. For exact observation of technique, surgeons still travel from city to city and from country to country, sometimes halfway around the globe. But the diligent student may sit at home and, in the quiet of his study, glean from periodical literature a wealth of information concerning the most recent thought and action of professional colleagues thousands of miles away.

Unfortunately, few medical men have sufficient familiarity with foreign languages to enable them to gather the major part of such teaching at first hand. Even to the polylinguist such a process is laborious and time-consuming, often out of proportion to the reward; for much that is written is mere repetition, and out of many tons of low-grade ore only a few grains of golden knowledge may be extracted. Here lies the value of the abstract departments of our best medical journals.

It is doubtful whether the average ophthalmologist realizes the extent to which the advance of his specialty depends upon reference literature. Perhaps it is not necessary for every practitioner of a specialty to be a master of literary research, since progress is often faithfully served by the willingness or eagerness of a few to communicate knowledge to others in colleges, clinics, meetings, and lecture courses. Yet development in any department of medicine is greatly broadened and facilitated by the existence of good abstract publications.

Nowhere has the habit of giving or accepting something for nothing been carried further than in the practice of medicine. The physician gives his services so widely and with so little accounting of value and cost, that it is perhaps not surprising he should be just as heedless in accepting gratuitous teaching and gratuitous literary service.

The circulation of journals dealing with special branches of medicine is so limited that the expense of their management and publication, if adequately measured and compensated, would far exceed the prices at which they are supplied to the subscriber. Fortunately, those who furnish such services in medical literature are largely inspired and encouraged by rewards and satisfactions of a less tangible character than direct financial compensation. Yet the facts that the laborer should be worthy of his hire, and that financial reward for labor is often the safest guaranty of its continuity, account for the disappearance of many excellent publications which the profession could ill afford to lose. The medical profession as a whole will be better served when it not only is more eager for good literary service but

develops a greater realization of the necessity of paying for what it gets.

In the long view, one of the most fruitful fields for endowment in relation to medical education might be found in adequate provision for an annual digest of the literature of ophthalmology such as was furnished by the Ophthalmic Year Book. Without endowment of some kind, no such enterprise can be assured of effective continuity independent of the vicissitudes associated with individual personality and self-sacrifice.

W. H. Crisp.

THE POSTCYCLOPLEGIC TEST

When the results of the test after recovery from cycloplegia do not agree with the test under cycloplegia, which should we rely on? This is a question often asked. But the answer depends on an if. If the last test has been made with a careful consideration of the case history and the results of all preceding tests, the last test should be the most reliable. But if that has been neglected, or the tests have consisted only of holding lenses before the eye and noting the vision obtained with them, the one may be no more valuable than the other.

For young children unaccustomed to recognizing letters, subjective tests are of little value. Their examination should begin with measurement of the corneal astigmatism with the ophthalmometer. Then, with full cycloplegia, the dilated pupil should be studied by skiascopy from different distances, including the test with careful correction of the astigmatism in the visual zone—the part of the pupil that will be used after the pupil is in normal contraction. The only subjective testing is to be for vision with the full correction, and the effect of adding convex or concave lenses to this full correction. After the cycloplegia has passed off, the subjective testing may be repeated, not to supersede but to throw light on the cycloplegic test.

In patients old enough and intelligent enough for subjective testing, the ophthalmometer may be used; with recognition of the fact that the total astigmatism of the eye is more likely to vary from the corneal astigmatism, both in amount and in the direction of the principal meridians of astigmatism. Then skiascopy should include careful observation of evidences of differences of ametropia between the visual (central) zone, and the peripheral zone of the pupil. Generally there are marked differences of spherical refraction between these zones, often one to three diopters. In such an instance the eye may be ready to accept a stronger convex lens with the contracted pupil than under full cycloplegia. In a few cases the aberration may be of the opposite kind, and the patient will choose a weaker convex lens with the contracted pupil; not because of the return of accommodation, but because the more hyperopic part of the pupil has been shut off by the iris. The objective evidence of skiascopy must decide what condition is really present.

Certain other points must be decided by skiascopy. When one half of the pupil is more myopic or more hyperopic than the other half, we must remember that only the central part will be in use when the pupil is contracted, and the correcting lens must be suited to that portion. Again, when there is a swinging or pendulum motion of light or shade in the pupil, it means that the principal meridians of astigmatism differ in the two halves of the pupil. If this has not been observed it is quite puzzling to find that in the postcycloplegic test, the axis for the correcting cylinder is found to differ from that found under cycloplegia. This is not a matter to be settled by any dogmatic rule, but by the collateral evidence from skiascopy. In each

such case the usual size of the contracted pupil, and the kind of light in which the eyes will be used, must be considered.

Finally, in all subjective testing, the most accurate determinations of the directions of the principal meridians, and of the strength of cylinder required is made with the cross cylinder. This should be used for both the cycloplegic and the post-cycloplegic tests. If the two disagree the latter should be repeated on different days, and the whole evidence secured carefully considered in arriving at a conclusion.

In patients who have reached the age of presbyopia, changes in the amount and meridians of astigmatism are most common. Cycloplegia does not generally enter into the case; but, even up to 80 years of age, there may be enough accommodation to be puzzling with reference to astigmatism. There may also be opacities in the media and regular astigmatism that reduce the acuity of vision. In these cases the size of the pupil must be considered; and the strength of light used which will bring down the pupil and diminish the effect of all irregularities of refraction. In these cases a single testing often leaves some uncertainty; and the subjective tests, being the only ones that can be used effectively, should be repeated again on different days, and under the most favorable conditions, until the examiner's mind is fully satisfied that he has reached the best result.

Edward Jackson.

PROGNOSIS IN OCULAR MALIGNANCY

The ability to prognosticate the probable outcome of a pathological condition is often very valuable, even though in most cases it may not be possible to alter the outcome in the given case. At least it allows time for one to attempt to make suitable provision in the event that the prediction should prove correct. The case in point is the ability to forecast the likelihood of metastasis from an ocular tumor. If examination of a neoplasm would allow of a reasonably accurate estimation of this, it would be logical in the unfavorable case to try every possible means to prevent metastasis, whereas extensive treatments involving much time, money, inconvenience, and even danger to the patient might not seem justifiable in cases in which there was little likelihood of metastasis. A knowledge such as this would also stimulate physicians to follow up their cases of tumor more carefully and attempt to find out in as nearly every patient as possible the exact outcome as to metastasis and, perhaps equally important, the location of any secondary growth, so that statistics would be available to indicate the part most likely to need treatment.

Admittedly the treatment of metastases has not as yet been very successful, but quite possibly the future holds some promise of better results, as undoubtedly penetration of the field of therapy has only just begun. To speculate on the type of such treatment would perhaps be idle. It may be that it lies in the realm of physics, possibly in that of chemistry. Certainly the progress made in the use of deep X-ray therapy during the past few years would indicate that merely a beginning had been made in this department. Only recently heads were shaken over the use of two-hundred-thousand volts, while now there are those who employ five-hundred-thousand to generate X rays.

No one has had the temerity to attempt to evaluate the changes induced in the deeper tissues by these high voltages, but that they are different from those of lesser voltage seems probable. We have learned enough of the selective action of radiations on different tissues, for instance the thermolability of neoplasms as compared to normal cells, to feel hopeful as to ulti-

mately finding emanations that will be highly lethal to every different type of malignant growth.

In 1931 G. R. Callender reported on a study of histologic types in 111 cases of melanotic tumors of the eye (Transactions, thirty-sixth annual meeting, American Academy of Ophthalmology and Otolaryngology, 1931, page 131), giving a prognosis based on the type of cell. He found that the epithelioid, fascicular, and mixed-cell types were among the more malignant and that the spindle-cell subtypes were comparatively benign. Quoting from a more recent publication (G. R. Callender, M.D., and Helenor Campbell Wilder. Melanoma of the choroid: The prognostic significance of argyrophil fibers. The American Journal of Cancer, 1935, volume 25, October, no. 2): "The spindle-cell type, consisting of fusiform cells with long oval nuclei, is subdivided into (A) those in which the nucleus has a delicate, reticular structure with the nucleolus not well defined, and (B) those having a rather coarse nuclear network and a prominent nucleolus. The epithelioid type is composed of polygonal cells usually of relatively large size, though there is considerable variation both in size and shape. The nucleus is large, round or somewhat oval, and the nucleolus is distinct. The fascicular type is based rather on the columnar arrangement of the cells than on nuclear morphology. The mixed-cell type is, as the name indicates, a combination of two or more of the above types." In the meantime Wilder had hit upon "An improved technique for silver impregnation of reticulum fibres" (The American Journal of Pathology, 1933, volume 11, September, no. 5). Quoting from this reference " . . . glia cells in paraffin sections of formalin-fixed tissues may be impregnated, rapidly and without the use of heat, by sensitization with uranium nitrate prior to the exposure to ammoniacal silver (Foot's silver diammino hydroxid). The method presented in this paper is based on Foot's reticulum stain and the sensitization method for glia. It is very rapid and stains the finest reticulum fibers with great precision, collagen appearing rose-colored as in Foot's stain."

By using this method Callender and Wilder (see reference) have studied the 111 cases previously reported by Callender and an additional 162 cases. They state that "The study of argyrophil fibers, present in varying amounts in melanomas of the choroid, appears to offer further criteria for the determination of the relative malignancy of these tumors." A study of the fiber content of 205 cases of choroidal melanomata strongly suggests an apparent connection between fiber content and prognosis. "Fiber distribution varied in a marked degree in different tumors and in different areas of the same tumor. Every gradation was found from a complete absence of fibers to a dense intercellular network." The authors' conclusions follow: "(1) Classification according to fiber content is particularly valuable for subdividing melanomas of the mixed-cell type into groups of relative malignancy, and deaths in the spindle-cell group appear to be explained by the presence of areas containing no argyrophil fibers. (2) Classification according to fiber content in conjunction with cell typing affords an aid in prognosis, an abundance of fiber production indicating a more favorable prognosis and a decrease in fiber production denoting an increase in malignancy. (3) The original classification by cell type, based on hematoxylin and eosin staining, still holds, but a more accurate prognosis is made possible by additional classification according to fiber content."

This publication is now a year and a half old. It was brought to attention again because of a recent project to carry the investigation further. With this we are

heartily in accord. Callender's and Wilder's studies deserve to be widely known among ophthalmologists and this latest publication of theirs may quite possibly have been overlooked since it appeared in a journal not often seen by ophthalmologists. It would be very desirable that a few sections from each malignant ocular tumor be tested for fiber content after Wilder's method, or if it is not possible for the ophthalmologist to have this done locally, that a part at least of the specimen be sent to the Army Medical Museum for this special study, and that a most careful clinical follow-up of the patient be made. In this way a large amount of material could soon be studied and the value of the method be determined within a reasonably short length of time. We recommend to our readers a careful study of the papers cited on this subject. They are interesting and instructive, brief and well illustrated.

Lawrence T. Post.

BOOK NOTICES

A COLLECTION OF 58 ARTICLES ON OPHTHALMOLOGY DEDICATED TO PROFESSOR DOLGANOV ON THE 45TH ANNIVERSARY OF HIS MEDICAL CAREER. Clothbound, 468 pages. Published by Military Medical Academy, Leningrad, 1936.

Professor Filatow gives the indications and contraindications for transplantation of the cornea from his experience with 250 cases. Thick opacities without visible remains of corneal elements rarely give a permanent transparent healing of the transplant. The eyes of cadavers, removed 2-3 hours after death and preserved for 20 to 30 hours at a temperature of 4-6°C. afford suitable material for transplants.

Regarding the histology of partial penetrating transplantation of the cornea, Kopp finds that one of the important causes of the opacity in the transplant is the result of the formation of anterior synechiae. The latter can be avoided by the use of adrenalin injections before the operation and atropine during the first days after the operation.

Poljak reports on the technique and results in 160 operations for removal of the lacrimal sac together with the lacrimal ducts.

Plastic work on the eyelids with transplants of fascia lata and of the auricle, observations on the dark-adaptation of chauffeurs employed at night, in glaucoma and in pigment degeneration of the retina are described. The vertical enlargement of the blind spot in nasal conditions, inversion of the color fields in hemeralopia, the influence of different kinds of light in research with the color tables of Ishihara and of Chaaf, and the essentials of the instrument scales of aircraft for the lowest limit of lighting in the pilot's cabin are discussed.

Dyban recommends the intramuscular injection into the gluteus of 40 to 60 c.c. of 0.25-percent novocaine solution in a modified Ringer solution for purulent corneal ulcer. In only three out of 53 cases treated did the process fail to respond.

Gastev found that the application of chaulmoogra oil to 31 trachomatous eyes resulted in 12 or 39 percent being healed, whereas 13 or 42 percent showed an improvement.

Sandomir employs the pellicle from a hard-boiled egg for separating two contiguous injured surfaces of the conjunctiva to prevent symblepharon.

From retrobulbar injections of 0.1-percent atropine in 35 persons with optic atrophy, Kosmine found an improvement of vision in 73.5 percent; in 58.3 percent of the cases, the vision in the fellow or untreated eye also increased. The field of

vision improved in 41 percent of the cases.

For obstinate epiphora, Tschutko recommends the injection into the palpebral part of the lacrimal gland of .75 c.c. of 70- to 80-percent ethyl alcohol. In 21 or 75 percent of the 28 cases treated a successful result ensued.

Bruk describes the deposit of fat as observed with the slitlamp in 17 cases of trachomatous pannus. By anatomic examination, the fat was found to lie between the corneal lamellae and intracellularly in the endothelium of the blood vessels.

Poljak reports the removal through the sclera of a cysticercus in the region of the macula 3-4 P.D. in diameter with a resulting vision of 0.05.

Harvey D. Lamb.

BULLETINS ET MÉMOIRES DE LA SOCIÉTÉ FRANÇAISE D'OPHTALMOLOGIE, 1936. Paper cover, 361 pages. Paris, Masson et Cie, 1936.

This volume, containing transactions of the forty-ninth annual meeting of the French Ophthalmological Society is arranged in the usual order of publications of this type. The first third of the book includes the business transactions of the Society and a list of its members.

The scientific meetings were extensive and covered a great variety of subjects. In general the subject matter is of clinical interest, of value to the practicing ophthalmologist. An attempt even to enumerate the list of titles would consume too much space for this review but one paper should be pointed out, namely, "Roentgenography in ophthalmology," by Dr. Edouard Hartmann. This paper was of sufficient value and extent to be published under a separate cover (see this Journal, 1936, p. 809). There are several reports on retinal detachment by important workers in this field. A review of these papers alone is very valuable to the reader.

In going over this volume one gains the view that this meeting is of international importance in ophthalmology and it makes one wish to attend some subsequent meeting. The program has been well worked out in advance so as to make the average practicing ophthalmologist find it worth while to attend because of the varied subject matter as well as the distinction of the individual speakers.

H. Rommel Hildreth.

TRACHOMA. By A. F. MacCallan. Clothbound, 225 pages, 19 figures. Butterworth and Company, Ltd., London, 1936. Price £1.1.0 net. (See also this Journal, Jan., 1937, p. 80.)

Trachoma is found in such limited areas in the United States, and such care has been given to its control by the Federal Government and through private agencies, that it is no longer with us a problem of primary importance. We can, therefore, have little realization of the extent to which it prevails and how serious are its effects in other countries.

In a smaller volume published in 1913, MacCallan, who for twenty years until his resignation in 1924 had been Director of the Ophthalmic Hospitals in Egypt, showed that more than half a million persons at that time were blind in one or both eyes. Because of the unwillingness of people generally to declare their infirmities, he estimated that double this number would be a truer estimate, making a million people or nine percent of the total population so afflicted. Notwithstanding the intensive work carried on in Egypt for many years and especially during the last decade, conditions as to ophthalmia are still very bad. A study was made by Wilson in the village of Bahtim and the results published in 1929 in the annual report of the Memorial Ophthalmic Laboratory in Egypt. In this village,

which is typical of others in Egypt, out of 2,018 of villagers studied only 24.5 percent had normal eyes. Twenty-five percent of the children are infected with trachoma before the end of the first year.

Palestine has the unenviable reputation of having a greater percentage of blind persons among her population than any other country in the world. In the southern district 2.8 percent were blind in one eye and 1.1 percent were blind in both eyes. This very high percentage is related to the scarcity of water in the southern district. The difficulty of prophylaxis is due to overcrowding and insanitation.

Trachoma is practically universal among the Mongolian and Semitic races of the East, and among the Red Indian tribes. It is widespread among the Caucasians of India and among the Malayans. It is also prevalent in some parts of the vast continent of South America. It would not be too much to say that stigmata of the disease, active or cured, are borne by half of the inhabitants of the globe.

In these days of extensive travel it becomes of importance to the whole world that all possible measures shall be taken for control of this infectious disease. Its effects, unless controlled, may extend to parts of the world in which it is not usually present.

Noguchi's discovery in 1927 of bacterium granulosis, although important, has not been accepted as determining the specific cause of trachoma in man.

This book is beautifully printed on heavy unglazed paper of a tint most agreeable to the eye. The illustrations, especially the drawings reproduced from the work of Cuénod and Nataf, are exquisitely done. Coming from such an accepted authority on the subject as MacCallan, the volume will serve as a work of reference to all interested in the subject.

Park Lewis.

PRACTICAL ORTHOPTICS IN THE TREATMENT OF SQUINT. By Keith Lyle and Sylvia Jackson. xvi + 212 pages, 5 plates (4 colored) and 64 text illustrations. Cloth binding. London, H. K. Lewis & Co. Ltd., 1937. Price 12s. 6d. net.

Many volumes on orthoptic treatment have appeared in the last few months. Most of them have been excellent, each succeeding one seeming to come nearer to a satisfactory understanding of the subject. This latest book contains a consideration of phorias in addition to tropias. Some of the conclusions of the authors are worth noting here. In general they agree with the accumulating evidence on the subject. For example: In the treatment of squint patients should attend the clinic three times a week until almost ready for discharge. " . . . in those cases cured by orthoptics alone the average number of attendances per case has been 48, half an hour's treatment being given at each visit. The treatment usually extends over four or five months." " . . . each case must have the undivided attention of the orthoptist at every visit." " . . . probably six years is the ideal age at which to commence treatment." " . . . if a case fails to improve over a period of six consecutive orthoptic treatments, it is uneconomical to continue, and an operation should be considered without delay." " . . . improvement of squint on homework exercises is rare" (in clinic patients; more successful in private practice).

Chapter 2 describes certain instruments which are used in the clinic and with which the authors have done their work; that is, at the Royal Westminster Ophthalmic Hospital orthoptic clinic under the direction of Miss M. C. Maddox: the synoptophore, the cheiroscope, the myoscope, and various stereoscopes.

Those working with orthoptics will be especially interested in the statements on occlusion. The authors write: "If there is

no improvement in the vision after a month, and it is certain that the occlusion has been conscientiously and efficiently carried out, it is useless to continue it. It has been found that 30 percent of our amblyopic cases have failed to improve on occlusion." "No cases with loss of central fixation or with eccentric fixation have improved on occlusion of the sound eye." "The average age of patients in whom occlusion has resulted in satisfactory improvement of vision—that is to say, where the vision has become approximately equal to the other eye—is 8½ years. . . ."

In the method of examination, after taking the vision, the presence of binocular vision is determined with Worth's Lights. The next study is on the synoptophore. A clear definition of angles alpha, gamma, and kappa, with methods of measuring them is given.

The subject of abnormal retinal correspondence is dealt with in considerable detail. All modern writers concur in an appreciation of the importance of this element in the treatment of squint. The results obtained by the authors in overcoming this have been unusually good. Their method is described in detail.

Simultaneous perception with methods for its development are then considered. The next chapter is on fusion and stereopsis. Finally squints are classified and the difficulties met in the treatment of each type are pointed out. Tables of results are given.

The principles which should guide operations for squint are contained in a short but important chapter. When operating for purely cosmetic results, ages of nine to 13 years are chosen, chiefly because of the advantage of being able to use local anesthesia. The surgeon is advised to begin orthoptic treatment eight days after advancements, two or three days after tenotomies, five or six days after recessions or reefings.

The book is recommended as a useful addition to the cumulative literature on the subject.

Lawrence T. Post.

LIGHT. THE RAW MATERIAL OF VISION. By Thomas Hall Shastid, M.D. 64 pages, clothbound. Ann Arbor, Michigan, George Wahr Publisher to the University of Michigan, 1936.

For an evening's entertainment which will contain much instruction, the reviewer recommends this clearly and simply presented monograph on the nature of light and its reception by the percipient elements of the eye. The author has delved deeply into the subject and has presented it in an extremely modern manner. An interesting historical sketch of the varying views of the nature of light precedes the discussion of present concepts.

The contributions of Newton, Huyghens, Roemer, Young, Foucault, Maxwell, Millikan, Einstein, and others are discussed. The theory of relativity is comprehensibly presented as well as the marvelous implications of light velocity. Definitions of matter and energy with their origins and their places in the universe are subjects of speculation. The last 12 pages have to do with the process by which these elements are converted into vision. The author ends in theosophical philosophizing which will impress most readers as being somewhat fantastic.

The author has suggested several new terms which seem to the nontechnical reviewer to clarify some of the confusing elements in the discussion of energy and matter.

Lawrence T. Post.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Anthonisen, Harold. **Studies on the relation of visual acuity to illumination.** Acta Ophth., 1936, v. 14, pts. 3-4, p. 437.

The light was controlled with Tscherning's photometric lenses and the visual acuity measured with the Landolt ring, and by the test person's accuracy in focusing a Zeiss ophthalmometer on an artificial cornea. The detailed report shows that visual acuity is directly proportional to illumination, and the author does not agree with the findings of Edmund and Möller, who maintain that up to certain limits visual acuity is independent of illumination.

Ray K. Daily.

Birch-Hirschfeld, A. **The five-point adaptometer for determination of the light sense, in new improved form.** Klin. M. f. Augenh., 1936, v. 97, Oct., p. 433.

The apparatus, manufactured by Carl Zeiss, Jena, is illustrated and described in detail. In the tests absolute values are not determined but a comparison is made between the light adaptation of the subject, and that of a person considered normal. The method proved very useful in examinations of aviators. (Illustrated.) C. Zimmermann.

Burian, H. **Studies in binocular depth perception by means of topical screening.** Graefe's Arch., 1936, v. 136, p. 172.

Using the fan-horopter apparatus of Tschermak-Seysenegg as well as Tschermak-Seysenegg's modification of Hering's horopter apparatus, numerous detailed observations confirmed the possibility of binocular depth-perception by topical screening.

H. D. Lamb.

Enroth, E., and Werner, S. **Examination of the light sense with intermittent light.** Acta Ophth., 1936, v. 14, pts. 3-4, p. 320.

A comparison of the diagnostic value of the data obtained by taking the fusion frequency in various stages of adaptation and measuring the threshold of perception. The study was made on four normal persons and on three patients with reduced light sense. The detailed report shows that a differential diagnosis possible with data on fusion frequency cannot be made from data on the threshold of perception.

Ray K. Daily.

Gerhartz, H. **The serologic tuberculous test in ocular tuberculosis.** Graefe's Arch., 1936, v. 136, p. 387.

Among 16 cases of iritis tested for tuberculosis according to Besredka's complement-fixation method, 5 were defi-

nitely positive, 3 were faintly positive, 1 was doubtful, and 7 were negative. Two of the cases faintly positive by Besredka's test were negative when Meinicke's test was employed and 3 cases negative according to Besredka's method were negative when tested according to Meinicke. Of eight cases of keratitis tested for tuberculosis by the complement-fixation test of Besredka, 2 were definitely positive, 3 faintly positive, and 3 negative. Complement-fixation tests on 4 cases of vitreous opacities resulted in 3 positives and 1 negative. Among 21 cases of optic neuritis, Besredka's test was positive in 4, faintly positive in 10, doubtful in 2, and negative in 5 cases. H. D. Lamb.

Kotlarevskaja, S. Z., and Kiseleva, E. H. **The hydrophile test in scrofulosis.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 2, p. 185.

The test consists in injecting intradermally 2 c.c. of normal saline solution and timing the disappearance of the bleb thus formed. The author tested 43 children with scrofulosis. The tabulated results show that there is no relation between the type and stage of the ocular disease and the rapidity of disappearance of the papule. Nor does the test indicate the degree of sensitivity to tuberculin. In most patients with active pulmonary lesions the absorption of the solution was delayed. The author does not consider the test to be of diagnostic value in ophthalmology.

Ray K. Daily.

Kugelberg, I., and Sandstrom, A. E. **Spectral relations of the blood in direct light.** Graefe's Arch., 1936, v. 135, p. 561.

Spectroscopic examination of light reflected from the fundus of the living human eye (red fundus reflex) shows chiefly a diffusion spectrum from the blood in the choroid. H. D. Lamb.

Lijo Pavia, J. **Infrared ophthalmoscopy and retinography.** Rev. Oto-Neuro-Oft., 1936, v. 11, Nov., p. 298.

By utilizing the Ilford B filter, Lijo Pavia employs longer wave lengths than those employed by Kugelberg and Diaz-Caneja. For indirect ophthalmoscopy with the simplified binocular ophthalmoscope dark adaptation is secured by preliminary ophthalmoscopy with filter absorbing 60 to 70 percent of the light and closing the eyes for a minute. For direct ophthalmoscopy with the high intensity "oculus" ophthalmoscope he uses preliminary examination with red-free light, without closing of the eyes. A dark room is necessary and moderate mydriasis. The author's observations differ somewhat from those of others. Pigment appears black, hemorrhages are less intensely black and with margins more blurred. Arteries and choroidal vessels are visible as translucent bloodless cords, while veins acquire the tone of arteries in ordinary light. The physiologic excavation is pink, and the pigment ring of the papilla clear-cut, while in glaucoma an intensely white excavation is bordered by a translucent wreath. The papillomacular region is grey. In macular degeneration fine pigment striae are seen. The choriocapillaris seems thickened in retinitis pigmentosa, and in senile exudative retinitis there is a mass (measuring as much as two diopters in depth) lying in front of the choroid. In direct ophthalmoscopy the foveolar reflex and an occasional perivascular reflex are seen. Cholesterin deposits are seen as little vesicles, and patches in front of vessels become translucent. A detached retina permits exploration of the choroid. In a cured case of choroiditis as many as four planes of lesions could be observed. Infrared ophthalmoscopy permits visualization of pigment invasion of the macula of myopes. Infrared retinography has not been found satisfactory because of the long exposures required (½ to 1 minute) and the intense heat. Lijo Pavia believes that the good retinographs secured by Diaz-Caneja have been achieved by use of red-orange radiation rather than by infrared rays.

M. Davidson.

Neumann, Jacob. **On the dependence of the pupillary distance on the interorbital distances in normal and squinting individuals.** Klin. M. f. Augenh., 1936, v. 97, Oct., p. 491.

The pupillary distance depends on the interorbital distance and the horizontal diameter of the orbit. The interorbital distance is determined by the distance between the cristae lacrimales posteriores and is directly measurable only on the skeleton. In the living the distance between the inner angles of the eyes, which is somewhat larger, corresponds to it. The measurements on 250 persons with parallel visual lines, and on 43 squinting individuals, are described, with technique. In the majority of cases with parallel visual lines the center of the pupil of the normal eye lies midway between inner and outer orbital margins.

C. Zimmermann.

Osterberg, G. **A sight-test chart for children.** Acta Ophth., 1936, v. 14, pts. 3-4, p. 397.

A new pictorial chart for testing visual acuity. Ray K. Daily.

Paul, Ludwig. **Localization by ophthalmoscopy. 4. The percentage calculation for the eyeball.** Graefe's Arch., 1936, v. 135, p. 482.

Designation of size of an eye is much clearer if expressed as a percentage value in comparison with a normal eye ("prototype eye"). One compares the corneal radius of the observed eye with the corneal radius of the schematic eye. Varying lens refraction and depth of anterior chamber lead to change of the axis length of the emmetropic secondary eye, which can be expressed as percentage value of axis length of the prototype eye. With greater variations of the axis length, the eye is ametropic. With varying lens value, calculation of the ametropic axis length is correctly furnished by introduction of a compensating coefficient. Tables and formulae are given to permit the determination in every eye of the absolute value of the corneal refraction, depth of the anterior chamber, lens refraction, and apparent and true axis lengths of the eye.

H. D. Lamb.

Post, L. T. **Comparison of suprarenin bitartrate and cocaine plus euphthalmine as mydriatics for elderly patients.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 33-39.

Salsbury, C. R., and Melvin, G. S. **Ophthalmoscopic signs of death.** Brit. Med. Jour., 1936, June 20, p. 1249.

The authors report definite changes in the veins, visible with the ophthalmoscope, appearing in the dead or dying. As death approaches, the blood stream gets lumpy and later there is a definite fragmentation of the blood column. As movement has ceased, the columns are plainly visible. These signs may be of practical value in determining whether or not resuscitation is possible. Theodore M. Shapira.

Spinelli, Francesco. **An ophthalmoscopic topographic chart.** Soc. Oft. Ital., 1934. Reprint in Saggi di Oft., 1934-1936, v. 8.

Spinelli has developed a method of scleral localization of retinal tears and disinsertions, applicable to and attached to the simplified Gullstrand ophthalmoscope. A field chart was developed from Listing's reduced eye. Outside the largest circle are twelve Roman numerals, as in a clock. Inside this circle are degree markings, from zero to 360, in five-degree intervals. Concentric circles at five-degree intervals complete the chart. The author has found this method of mapping tears and other retinal defects very dependable. (4 figures.)

Eugene M. Blake.

2

THERAPEUTICS AND OPERATIONS

Attiah, M. A. H. **Therapeutic notes.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 172.

In tattooing of the cornea with platinum chloride, the author advises (1) that only sterilized water be used as a wash, (2) that the area to be tattooed be delimited by a knife or needle and extend a little beyond the opacity, (3) that the superficial epithelium be scraped off uniformly, (4) that bleeding vessels be cauterized because adrenalin spoils the action of the reagents, (5) that solutions be fresh and that to avoid irritation no more than a two percent solution be used.

For argyrosis, a twelve percent solution of sodium thiosulphate with two percent potassium ferricyanide in sterile water is recommended, in multiple subconjunctival and subcutaneous injections of from 0.25 to 1 c.c.

Subconjunctival injection of 0.25 c.c. of splenic extract in the upper fornix is recommended for relief of spring catarrh, repeated every other day for from three to nine injections.

Edna M. Reynolds.

Attiah, M. A. H., and Sorour, M. **A preliminary note on the therapeutic value of embryonic tissue extract in eye diseases.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 180.

Because embryonic tissues contain nutritive substances essential for tissue growth in vitro, the authors conducted a series of experiments in which they attempted to stimulate healing of corneal lesions by subcutaneous or intramuscular administration of an aqueous extract of tissue derived from fresh human placenta and umbilical cord. The extract was given in doses from 0.5 to 2 c.c. daily. Experiments with rabbits were not conclusive because corneal ulcers in rabbits tend to heal spontaneously. In 32 cases of corneal ulcer in man the injections shortened the period of active ulceration and quickly lessened the amount of discharge where there was acute conjunctivitis. Old and emaciated patients responded even better to the injections than young and healthy subjects.

Edna M. Reynolds.

Batrachenko, P. M., and Askalonova, T. M. **Diathermy in diseases of the eye.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 2, p. 149.

Tabulated results of treatment show that diathermy hastens healing and resolution of pathologic processes in optic neuritis, vitreous opacities, iritis and iridocyclitis not tuberculous or syphilitic, incipient cataract, scleritis and episcleritis, transplantation of free transplants, and cicatrization following exudates. In sympathetic ophthalmia and immature cataract it is less effective but acts favorably. It is ineffective in diseases of the optic nerve (with the exception of those caused by quinine, typhus, and serous meningitis), chorioiditis (except malarial), retinal detachment, traumatic and mature cataract, retinitis pigmentosa, and keratitis. It is contraindicated in glaucoma, perforating ocular injuries, and trachoma.

Ray K. Daily.

Farid, Nasr. **Pantocain anesthetic effect on conjunctiva and cornea.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 177.

Pantocain is -preferred because its anesthetic effect is ten times stronger than cocaine in the same dilution and because there is no irritation of the conjunctiva or drying of the cornea. The only drawback is slight dilatation of the blood vessels. Edna M. Reynolds.

Grzedsielki, J., and Lapierre, J. de. **Treatment of ocular tuberculosis with spleen extract.** Klinika Oczna, 1936, v. 14, pt. 5, p. 631.

The author found intramuscular injections of splenic extract very efficacious in tuberculous iridocyclitis, superficial scleritis, disseminated choroiditis, and phlyctenulosis. Ray K. Daily.

Hardy, William F. **The rôle of paracentesis in ophthalmology.** Amer. Jour. Ophth., 1936, v. 19, Dec., pp. 1097-1101.

Heath, Parker. **Neosynephrin hydrochloride; some uses and effects in ophthalmology.** Arch. of Ophth., 1936, v. 16, Nov., pp. 839-846; also Trans. Sec. on Ophth. Amer. Med. Assoc., 1936, 87th annual meeting.

The general and local action of this drug are discussed and the results of its use on animal eyes reported. The drug is useful to ophthalmologists to dilate the pupils for fundus examinations and to break synechiae in cases of iridocyclitis. It is of some value in differentiating the various kinds of glaucoma and as a decongestive agent and a vasoconstrictor of the conjunctival vessels.

J. Hewitt Judd.

Howell, S. C. **Action of epinephrin on the diseased human eye.** Arch. of Ophth., 1936, v. 16, Dec., pp. 1018-1027.

The uses of a strong solution of epinephrin bitartrate are discussed and illustrated by case reports. It is especially beneficial in primary and secondary glaucoma, as a mydriatic for ophthalmoscopy, and for freeing iris synechiae. Occasionally an acute, resistant form of glaucoma is precipitated, which requires surgical treatment. J. Hewitt Judd.

Johannson, Ernst. **Impletol in ophthalmology.** Zeit. f. Augenh., 1936, v. 90, Dec., p. 301.

Favorable results from subcutaneous injection of local anesthetics for relief of headaches have been reported, and the proprietary combination of novocaine and caffein marketed as "Impletol" seems very efficacious. In the last four years the author has rarely been disappointed in using this treatment for headaches of any type except hysterical or those of psychic origin. He lists many causes of headache in cases which gave brilliant results, and he emphasizes that the treatment was particularly satisfactory for herpes zoster ophthalmicus. In three cases of blepharospasm, impletol injections effected a cure. F. Herbert Haessler.

Klauber, E. **Specific and nonspecific treatment of ocular tuberculosis.** Med. Klin., 1936, v. 32, Oct. 9, pp. 1398-1399.

With exceptions ocular tuberculosis is suitable for specific treatment with tuberculin. The author's choice of preparation is bacillary emulsion (Behring), which is given subcutaneously or intracutaneously. The initial doses are chosen so that they are followed by moderate local and general reaction. Careful control of the patient's temperature is essential. The author has never seen any beneficial effect from doses so small as to elicit no general reaction.

As the effect of tuberculin therapy is not immediately evident, it is advisable in acute conditions to give simultaneously a nonspecific treatment, which may consist of intravenous injections of gold or mercury solutions or calcium gluconate. Bertha Klien.

Kokott, Werner. **The question of treatment of the eye with short waves. Investigations on heating of the vitreous of rabbits by short-wave radiation with a tubular applicator.** Klin. M. f. Augenh., 1936, v. 97, Oct., p. 448.

The method is discussed in detail. The caloric topography of the nonradiated vitreous and the caloric changes in it after short-wave radiation were measured with the thermo-electric needle. The degree of heat in the vitreous after ten minutes of radiation seemed little capable of increase by longer continuation. For therapeutic employment of short-wave radiation we have to learn to limit the field of action more accurately and to avoid undesirable incidental effects.

C. Zimmermann.

Nastri, Francesco. **Researches on the physiopathology of the patient after an ophthalmic operation.** Boll. d'Ocul., 1936, v. 15, Oct., pp. 1094-1108.

The writer investigated and gives in tabulated form the variations in amount of chlorine, calcium, and glucose in the blood of patients after operations on the globe. The decrease in the percentage of these substances remained within physiologic limits. The author concludes that the humoral syndrome after an ophthalmic operation never reaches the character and magnitude found in general surgery. (Bibliography.)

M. Lombardo.

Possenti, G. **Cod-liver oil for local application in ophthalmology.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 96.

Possenti employed cod-liver oil in strength from ten to fifty percent in the form of an ointment and applied directly to the eye in such conditions as asthenic corneal ulcer, phlyctenular keratitis, trachoma in the cicatricial stage, blepharitis, and xerosis. The ointment is well tolerated and does not exclude other forms of treatment. In experimental infection of rabbit cornea the fifty percent pomade showed definitely antiseptic properties. The results are explained as being due to antiseptic action, increased supply of vitamin D, and stimulation of epithelial tissue.

Eugene M. Blake.

Post, W. L. **Neosynephrine.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 170-177.

Riva, Alberto. **Protein therapy in ophthalmology.** La Semana Medica, 1937, v. 44, Jan. 7, p. 63.

At rather considerable length the author reviews the various forms in which foreign protein has been administered, and the variations of technique. He gives a number of illustrative cases. He has obtained excellent results from the use of milk in the treatment of corneal ulcer with or without hypopyon, acute dacryocystitis, lid abscess, sty, ulcerative blepharitis, and iritis and iridocyclitis. He feels that in herpes and dendritic keratitis, and also in syphilitic parenchymatous keratitis, the course of the disease is shortened by milk injections. W. H. Crisp.

Salvati, G. **Clinical contribution to the pathogenesis of expulsive hemorrhage.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 229.

Fifteen cases are reported by the author to prove his contention that expulsive hemorrhage is due to a combination of preëxisting ocular hypertension, generalized arteriosclerosis, increased blood pressure, and the disturbed equilibrium which follows opening of the eyeball.

Edna M. Reynolds.

Shereskevskaja, L. I. **Erythema doses of ultraviolet light in disease of the anterior ocular segment.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 2, p. 193.

On the basis of sixty cases treated with erythema doses of ultraviolet light, the author concludes that the treatment has no effect on serpiginous ulcer; that it hastens resolution of the pathologic process in some ulcers and deep keratitis; that it is very effective in eczematous keratoconjunctivitis associated with eczema of the face; and that it is the best therapeutic agent for acute iritis. Ray K. Daily.

Yanes, T. R. **Simultaneous surgery on both eyes.** Rev. Cubana Oto-Neuro-Oft., 1936, v. 5, July-Aug., p. 127.

This is condemned as dangerous. For the sake of safety, the author postpones discission for secondary cataract until after extraction of the cataract of the other eye, and does not do a discission on an only eye. M. Davidson.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Brown, E. V. L. **Apparent increase of hyperopia up to the age of nine years.** Amer. Jour. Ophth., 1936, v. 191, Dec., p. 1106.

Burian, H., and Schubert, G. **The manner of reaction of the pupil for the near position.** Graefe's Arch., 1936, v. 136, p. 377.

Through study with the haploscope, and by entoptic observation of the pupil, it can be demonstrated that the reaction of the pupil for near is absolutely connected with convergence. Examination of the intersecting lines of the caustic surface of the finite bundle of rays refracted in the eye shows that the functional significance of constriction of the pupil in production of the best possible resolving power of both eyes provides the hypothesis for best possible sharpness of depth perception. This constriction of the pupil does not concern the near position of the single eye but is definitely associated with binocular vision. Its intrinsic functional significance consists also in a widening of the stereoscopic visual range for finer objects. H. D. Lamb.

Ferree, C. E., and Rand, G. **A new visual-acuity and astigmatism test chart.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 21-32.

Fortin, E. P. **Entoptic phenomena: perception of luminous waves, of one's own retina, and of pigment movements.** Arch de Oft. de Buenos Aires, 1936, v. 11, Oct., p. 602; also La Semana Med., 1936, v. 43, Dec. 17, p. 1691.

A simpler apparatus than the one used before is described: a small arc-lamp, an orange-red filter, and a black-velvet screen with a stenopaic opening.

By looking at the incandescent lamp in a dark room through the stenopaic opening and filter and slowly retreating, in order to receive on the fovea a very thin pencil of rays, one can see undulations radiating from the fixation point surrounded by a lively dance of black granules. By facing the screen and illuminating one eye, protected with filter and supplementary smoked glass, and then turning the eyes in the direction of the other (reflected) eye until the latter just gets a glimpse of the lamp across the nose, one can see, after removing smoked glass, the retina of the other eye: the fovea, the vessels around it, their contractions, and, if the source of light is moved, fluorescence as well. According to Fortin, the external plexiform layer of the retina, or the intergranular layer, is a clear space in which long fibers, several hundred microns in length, float. Its function in the physiology of vision is important and it deserves further study.

M. Davidson.

Gassovskii, L. H., and Chochlova, A. H. **Distribution of sensitivity to white light in the periphery of the retina.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 2, p. 127.

The conclusions are as stated in the next abstract.

Gassovskii, L. H., and Nicholskaja, H. A. **Distribution of light sensitivity in the peripheral portions of the retina.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 2, p. 123.

The study shows that light sensitivity rises from the fovea to points ten degrees peripherally, temporally, and nasally. Here it attains its maximum and from here it falls toward the periphery.

Ray K. Daily.

Jackson, Edward. **Importance of aniseikonia.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 16-21; also Trans. Sec. on Ophth. Amer. Med. Assoc., 1936, 87th annual meeting.

Kessler, J. **Trichromatic systems in the service of dichromates.** Klin. M. f. Augenh., 1936, v. 97, Nov., p. 653.

Kessler shows how the normal color-perceiving apparatus of the eye may be replaced in a certain measure. Analogous trichromatic systems can be created by means of three glasses of equal luminosity with different curves of penetration. He obtained this by placing red, green, and blue glasses in a photometer. (Illustrated.)

C. Zimmermann.

Krause, A. C. **Carnosine of the ocular tissues.** Arch. of Ophth., 1936, v. 16, Dec., pp. 986-989.

Chemical analyses of the ocular tissues show no particular physiologic basis for the distribution of carnosine. The contents of the various tissues are given in a table. No anserine was found.

J. Hewitt Judd.

Kravkov, S. V. **The influence of sound upon light and color sensitivity of the eye.** Acta Ophth., 1936, v. 14, pts. 3-4, p. 348. (See Amer. Jour. Ophth., 1936, v. 19, Dec., p. 1126.)

Ostwalt, F. **My "new theory" of anastigmatic spectacle lenses. A reply to M. Sundqvist's article.** (See Amer. Jour. Ophth., 1936, v. 19, June, p. 532.) Graefe's Arch., 1936, v. 135, p. 601.

For the sight to remain free of astigmatism at all times behind the spectacles, the lens of the latter should possess such a curvature that the principal ray of light coming from a point in an object anywhere peripherally in the field of vision and passing, after refraction by the spectacle lens, through the point of rotation of the eye, shall produce at the retinal fovea a punctiform, anastigmatic image. The focus of the optic system formed by the spectacle lens and eye together in all directions of gaze must remain unchanged upon the optic axis of the spectacle lens. The author illustrates the essentials of his theory in a detailed diagram.

H. D. Lamb.

Pflimlin, R., and Strubin, F. **Investigations on the binocular visual process.** Klin. M. f. Augenh., 1936, v. 97, Oct., p. 459.

In their first communication (see

Amer. Jour. Ophth., 1936, v. 19, p. 59) the authors represented the space of binocular single vision with the required accommodation in a coördinate system. The total vergency was reduced to its two components, fusional and accommodative. In this system a straight line A B is the geometric locus of all points of binocular single vision. The necessary vergency to single binocular vision is found at the point of A B, which has the fixation distance as abscissa. The ordinate of this point is the required vergency. In a detailed discourse the measuring of the range of fusion and so on is discussed.

C. Zimmermann.

Strebel, J. **Cosmetic utilization of prisms.** Klin. M. f. Augenh., 1936, v. 97, Nov., p. 662.

After injuries causing descent of the orbital floor the disturbing cosmetic defect may be removed by placing before the artificial eye a prism base down in a spectacle frame. This brings the eye apparently to the level of the healthy eye. In a case of simultaneous ptosis the upper lid was lifted by a knob affixed to the nasal bridge of the frame.

C. Zimmermann.

Tansley, Katharine. **The effect of vitamin-A deficiency on the development of the retina and on the first appearance of visual purple.** Biochem. Jour., 1936, v. 30, May, p. 839.

Experimenting on suckling rats in which vitamin-A deficiency was induced, the author found the development of visual purple retarded and in some cases prevented, while the effect on the structure and development of the rods was not so marked. She agrees with Wald, who says that visual purple is formed by direct combination of vitamin A and protein.

Theodore M. Shapira.

Verhage, J. W. C. **The question of bilateral inheritance in ophthalmology.** Graefe's Arch., 1936, v. 136, p. 361.

From study of 142 individuals belonging to six families, it is found that anisometropia, hereditary in itself, shows no uniformity as to left or right involvement. It is only when it is combined with squint that one sees the anomaly on the same side in different generations. The data are so far insufficient to afford a conclusion regarding other ocular disorders.

H. D. Lamb.

4

OCULAR MOVEMENTS

Burian, H. **The optokinetic production of vertical divergence.** Graefe's Arch., 1936, v. 136, p. 215.

A series of horizontally parallel alternating black and white stripes of appropriate width are offered simultaneously to both eyes, being rotated in opposite directions at suitable speed so that the eyes in trying to fix on the stripes show vertical divergence. The observations show an added basis for the existence of an independent innervation-complex for vertical divergence.

H. D. Lamb.

Durr, S. A. **The O'Connor cinch-operation technique.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 178-180.

Fahmy, A. Y. **Three operations improved with success (advancement, cyclodialysis, entropion).** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 29. (See Section 8, Glaucoma and ocular tension.)

Florov, H. Z. **Ocular complications in malaria.** Sovietskii Viestnik Opht., v. 9, pt. 3, p. 321.

Three cases of transitory paresis of the abducens, complicating malarial attacks.

Ray K. Daily.

Franceschetti, A., and Schläppi, V. **A case of hyperfunction of the inferior oblique of the left eye as a result of bilateral paralysis of the superior obliques.** Arch. d'Opht., 1936, v. 53, Nov., p. 785.

A 32-year-old man sustained, in an unknown way, a fracture of the base of the skull. Following the accident it was found that he had paralysis of both superior oblique muscles. The left inferior oblique had secondarily contracted. The diagnosis was arrived at by careful analysis with the Maddox

rod and cross, Bielschowsky's apparatus, and Franceschetti's cyclophorometer, and it was concluded that the diplopia complained of was principally due to the overaction of the left inferior oblique. Myectomy of this muscle five months after the injury caused the diplopia to disappear and corrected the obliquity of images. (Illustrations, tables, bibliography.)

Derrick Vail.

Knighton, W. S., and Kelly, B. W. **Progressive muscle chart.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 182-183.

Marlow, F. W. **Tests for heterophoria: a protest.** Arch. of Ophth., 1936, v. 16, Dec., pp. 982-985.

The author feels that failures of his test of prolonged occlusion for heterophoria are due to the way in which the test is carried out and interpreted, and that the test is of value in all cases of heterophoria. J. Hewitt Judd.

Mendoza, Rafael. **Equalization of retinal images in treatment of alternating strabismus.** Rev. Oto-Neuro-Oft., 1936, v. 11, Nov., p. 309.

Having observed that squinters can sometimes straighten their eyes upon sacrificing the visual acuity normally present in one or both eyes, and that when diplopia is evoked in them by a prism they report one image larger than the other, Mendoza reports relief of alternating strabismus by placing before the eye which reports the smaller image a combination of a plus 5 D. sphere with a minus 6.50 D. sphere in front of it. M. Davidson.

Ohm, J. **The science of nystagmus. Communication 40. The relation between hemianopsia and optokinetic nystagmus.** Graefe's Arch., 1936, v. 136, p. 341.

Hemianopsia in itself admits of optokinetic nystagmus on both sides. This thesis is proved by many examples. No decided value attaches to the statement of Cords that when optokinetic nystagmus is absent toward the blind side the lesion is located in the descending optic radiations. There occur disturbances of optokinetic nystagmus where the cause has its location not in the descending optic radiations but in the chiasm and optic tract. When optokinetic nystagmus is considerably diminished toward the side of the hemianopsia, a further disturbance in the brain must be assumed.

H. D. Lamb.

Spiegel, E. A., and Scala, N. P. **The cortical innervation of ocular movements.** Arch. of Ophth., 1936, v. 16, Dec., pp. 967-981; also Trans. Sec. on Ophth. Amer. Med. Assoc., 1936, 87th annual meeting.

Experiments were conducted on cats to investigate the parts played by the ascending and descending fibers of the posterior longitudinal fasciculus and of the vestibular nuclei. The innervation of the vertical movements was studied separately, since cortical stimulation will elicit vertical movement after injury to the vestibular nuclei, which impairs the horizontal ocular movements. These studies show that conjugate ocular movements can be elicited by direct stimulation of the cortex, without stimulation of this subcortex. Lesions of the vestibular nuclei impair or prevent cortical innervation of retinal conjugate movements, while destruction of the pallidofugal system does not prevent conjugate movements. The descending fibers of the posterior longitudinal fasciculus play no part in the innervation for horizontal movements of the globe but the cortical impulses are transmitted from the vestibular nuclei through the ascending fibers to the nuclei of the ocular muscles. Vertical movements are elicited by stimulation of the system connecting the cerebral hemispheres with the midbrain. (Discussion.)

J. Hewitt Judd.

Szymanski, Jan. **Neo-myocampter with a suture.** Klinika Oczna, 1936, v. 14, pt. 5, p. 628.

In the author's myocampter the metal clip is replaced by a suture, removal of which is simpler than removal of the metal clip. (Illustrations.)

Ray K. Daily.

5

CONJUNCTIVA

Borszczewski, S. **The value of biomicroscopic study of the superior limbus in trachoma and conjunctivitis.** Klinika Oczna, 1936, v. 14, pt. 5, p. 671.

From study of the superior limbus in 144 cases of conjunctival pathology the author concludes that hypertrophy of the terminal bloodvessels of the limbus is characteristic of trachoma.

Ray K. Daily.

Caramazza, F., Toni, G. de, and Puglisi-Duranti, G. **The conjunctival manifestations of measles.** La Pediatria, 1935, v. 43, no. 3. Reprint in Saggi di Oft., 1934-1936, v. 8.

During a measles epidemic the authors studied the conjunctival mucosa of 46 children, directly and by means of the slitlamp. In 83 percent subepithelial nodules were noted on the lower palpebral conjunctiva. They were few in number, oval in form, opal in color, with a surrounding red zone. They developed rapidly during the incubation period and faded within a few days. Only thirteen percent of the children exposed to measles, but not developing the disease, showed these same nodules. It is suggested that the nodules represent a local reaction in subjects immune or refractory to the virus of measles. Eugene M. Blake.

Cattaneo, Donato. **Familial form of trachoma.** Rev. Internat- du Trachome, 1936, v. 13, April, p. 82.

After presenting an exhaustive study the author concludes that trachoma is transmitted mostly by family contact in infancy rather than contact at school and that similar clinical manifestations are presented by different members of the same family.

J. Wesley McKinney.

Cuénod, A., and Nataf, R. **New anatomic and experimental researches on trachoma.** Rev. Internat. du Trachome, 1936, v. 13, July, p. 129. (See Amer. Jour. Ophth., 1936, v. 19, Oct., p. 929.)

Dimitry, T. J. **The dust factor in the production of pterygium.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 40-45.

Kapuscinski, W. J., Jr. **Ocular pemphigus.** Klinika Oczna, 1936, v. 14, pt. 5, p. 575.

A review of the literature and a report of four cases. A man 68 years old with advanced pemphigus refused treatment. A woman sixty years old had a corneal transplantation which improved vision from light perception to recognition of large objects. Microscopic section of the excised segment showed a degenerative process without inflammatory phenomena. The other two cases, in young people under observation for years, responded best to ten percent dionin locally and intravenous injections of typhoid. Slitlamp and biopsy studies showed a degenerative process in the conjunctiva, particularly its epithelium. Involvement of the cornea is superficial. Chronic inflammatory processes are secondary and are caused by bacterial invasion of the already diseased tissue. (Illustrations.) Ray K. Daily.

Ling, W. P. **Keratitis punctata superficialis and swimming-pool conjunctivitis.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1381-1392.

Of 53 cases reported, one half were associated with swimming-pool conjunctivitis. The infection is probably of genito-urinary origin. The author found the central corneal lesions to be anterior to Bowman's membrane, capable of removal without scarring, and consisting of epithelial cells only. The attack of keratitis was always preceded by a very irritating catarrhal inflammation of the bulbar and palpebral conjunctiva, scanty discharge, and marked photophobia. Swimming-pool conjunctivitis was found to be an inclusion blennorrhea, so the author concludes that superficial punctate keratitis is a similar infection of the cornea and a complication of swimming-pool conjunctivitis. Two-thirds of the cases were bilateral and the spots usually required months to disappear.

Lawrence G. Dunlap.

McKee, S. H. **Two cases of diphtheria of the conjunctiva.** Canadian Med. Assoc. Jour., 1936, v. 35, Oct., p. 425.

These cases were not bacteriologically typical and the diagnosis was confirmed by guinea-pig inoculation. There was no involvement of other mucous membranes. Both cases cleared up without complication after administration of antitoxin.

Theodore M. Shapira.

Marcus, J. M., and Wainer, K. G. **The cytology of the conjunctiva in trachoma and follicular conjunctivitides.** Rev. Internat. du Trachome, 1936, v. 13, April, p. 68.

This is a comprehensive presentation of the cytology of these two conditions. The authors conclude that study of the cytology of the secretions is very important in differential diagnosis between trachoma and the follicular conjunctivitides. In trachoma are noted characteristic presence of embryonic lymphoblasts of polymorphous aspect with vacuolization of the cytoplasm and mitoses of the nuclei, presence of monocytes and histiocytes, a shift to the left in the neutrophiles, presence of the cell shadows of Humprecht, presence of plasma cells and mast cells, degenerative changes in protoplasm and nuclei of the epithelial cells, and rare occurrence of eosinophiles. In the follicular conjunctivides are noted absence of embryonic lymphoblasts (of the lymphoid type) and of the cell shadows of Humprecht, predominance of lymphocytes, presence of eosinophiles and monocytes, rarity of histiocytes and plasma cells, and perfectly normal appearance of the epithelial cells. J. Wesley McKinney.

Massoud, Farid. **Trachoma as an endemic disease in Egypt.** Rev. Internat. du Trachome, 1936, v. 2, April, p. 111. (See Amer. Jour. Ophth., 1935, v. 18, Oct., p. 952.)

Melnik, Wlodzimierz. **Ophthalmia nodosa from hairs of brown-tail moth.** Klinika Oczna, 1936, v. 14, pt. 5, p. 638.

This rare infection was contracted by a student of entomology, who after handling the parasite touched his own eye. (Illustrations.) Ray K. Daily.

Miller, Hugh. **Modification of the Desmarres operation for transplantation of the pterygium.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 165-169.

Pinkerton, F. J. **Hyperthermic treatment for acute gonorrheal ophthalmia.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 63-65.

Poleff, L. **Transmission to animals and cellular culture of trachoma.** Rev. Internat. du Trachoma, 1936, v. 13, July, p. 153.

Chickens, rabbits, and guinea pigs were infected with trachoma by an intraocular method of inoculation. Typical granulations, corneal vascularization, and iritis were produced. Rickettsia bodies were found in the material from the human beings and then again from the infected animals, but were not reinoculated into man. Cellular cultures from the trachomatous granulations of man and the experimental granulations in chickens were successfully grown in vitro. Here again Rickettsia bodies were found, as well as in the tissue of origin. J. Wesley McKinney.

Reginis, Maria. **The effect of febrile disorders on trachomatous complications.** Klinika Oczna, 1936, v. 14, pt. 5, p. 688.

The author reports marked improvement following pneumonia in two cases of severe trachoma, complicated by infiltration of the tarsus, pannus, and corneal ulcer. Ray K. Daily.

Trapesontzewa. **Trachoma and Noguchi's Bacterium granulosis.** Internat. du Trachome, 1936, v. 13, July, p. 149.

The author, studying a large number of cases in the U.S.S.R., was able to demonstrate Noguchi's Bacterium granulosis in all stages of trachoma. She does not at present attempt to give a definite etiologic significance to this bacterium. J. Wesley McKinney.

Woronycz, Nestor. **Combined operation in trachoma.** Klinika Oczna, 1936, v. 14, pt. 5, p. 695.

The author treated 120 cases of trachoma by incision of the granules, grattage of the conjunctiva with 1 to 100 bichloride of mercury, irrigation with 1 to 3000 mercury oxycyanide,

cauterization with the copper stick, second irrigation with mercury oxycyanide, drying with cotton, and subsequent use of the copper pencil. Marked papillary hypertrophy of the conjunctiva is reduced by curettage with a sharp spoon. The author finds that this procedure shortens the duration of the treatment and has a favorable effect on pannus. Ray K. Daily.

Yanes, T. R. **Unilaterial trachoma.** Rev. Cubana Oto-Neuro-Oft., 1936, v. 5, July-Aug., p. 107.

A unilateral case in a boy of fifteen years remained confined to one eye after four years. Trachoma is rare in Cuba. No sharp line of demarcation is believed possible between follicular conjunctivitis and trachoma. Increased susceptibility of the affected eye or immunity of the unaffected eye explains the unilateral cases, which constitute, according to the literature, two percent of all trachomatous individuals.

M. Davidson.

6

CORNEA AND SCLERA

Accardi, V., and Rossi, E. G. **Implantation of tissues into the anterior chamber.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., pp. 3-54.

The authors practiced implantation of various tissues into the anterior chamber of rabbits, including cornea, iris, sclera, lacrimal gland, pancreas, thyroid, thymus, suprarenal, liver, kidney, lung, striated and heart muscle, dura, fascia, fat, bone, ovary and testicle. In all, 110 implants were made. Study of them demonstrated that the anterior chamber was a good place for temporary growth of tissue inoculation but that the specific tissues and organs there implanted were soon replaced by new-formed connective tissue. This was true whether the transplant was homoplastic, autoplastic, adult, or embryonic.

Only in a small percentage of cases was it possible to obtain lasting transplant of ovarian tissue, and in these cases there was a reaction of the tissue to intravenous injection of the urine of pregnant women. No specific reaction could be obtained for any other tissue, even testicular or suprarenal.

The clinical behavior of rabbit eyes to the various tissue transplants, and the microscopic changes resulting in the eye and in the inoculated tissue, are fully described. Eugene M. Blake.

Bruck, A. J. **Deposits of fat in trachomatous pannus.** Arch. of Ophth., 1936, v. 16, Dec., pp. 950-963.

This change was found in sixteen out of five hundred patients with pannus. The opacities usually appeared first below the pupillary area and spread upward. The deposits consist of white spots with rather distinct outlines, situated along the blood vessels, mostly at the bifurcations, and show some tendency to unite and form irregular plaques. In all cases which were under prolonged observation, clarification of the cornea and improvement of vision took place. This started at the upper margin and spread downward. Six cases are reported in detail with drawings and photomicrographs.

J. Hewitt Judd.

Corrado, A. **Malignant scleritis.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 225.

Scleritis of extreme severity is reported in a man of 71 years. It commenced 3 mm. from the limbus and eventually involved the entire temporal half of the sclera. Beginning as a compact tumefaction of wine color it later developed reddish - yellow nodules. These ulcerated, leaving cavities from which caseous material was extruded. The cornea remained clear but uveitis developed. Healing occurred at the end of a year but iridodonesis with subluxation of the lens remained. Microscopic study of the necrotic material was negative, as was also inoculation into the anterior chamber of the rabbit's eye. No cause was found other than radiographic evidence of old healed pulmonary tuberculosis. A very complete résumé of the subject precedes the case history. (2 figures, one in color.)

Eugene M. Blake.

D'Osvaldo, E. **Clearing of nodular degeneration of the cornea through an**

intercurrent keratitis. Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 118.

The case reported was that of a 63-year-old man who presented typical bilateral nodular degeneration of the cornea (Groenouw). There was no familial history. Following the development of central lamellar infiltration of the left cornea, there was marked clearing of the degenerative spots which had been present. After three years the central infiltration was found to be much less dense. There was complete absence of vascularization of the cornea, a condition which preceded the clearing process in the two other similar cases reported in the literature. The clearing of the cornea is explained by stimulation of interchange of fluids and metabolic factors originated by infiltration of the corneal lamellae. (2 figures.)

Eugene M. Blake.

Durando, F. **Metastatic staphylococcus-aureus abscess of the subsclera.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 126.

Following appearance of abscesses in forearm and chin, a girl of eleven years presented herself with a yellowish elevation of the sclera just above the vertical meridian of the cornea of the right eye. There was hypopyon, cloudy cornea, and cloudy vitreous. After incision of the abscess the cornea cleared rapidly, the hypopyon disappeared, and the vitreous became transparent. Hernia of the iris developed, exposing the ciliary body and the root of the iris. Excision of the hernia resulted in a useful eye with normal vision. The abscess probably resulted from a very minute septic embolus which had lodged in a capillary outside the ciliary body. (3 figures.) Eugene M. Blake.

Licheri, G. **Expulsive hemorrhage following a perforating corneal ulcer.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 75.

A seventy-year-old farmer's wife had suffered a trauma to the left eye eight years before the present illness, with resulting blindness but no other symptoms. Following a blow from a branch of a tree to the same eye, a central corneal ulcer developed with a brownish, protruding herniated mass. Study of the eye following enucleation showed absence of lens and vitreous, evidence of old organized blood, and much fresh blood. A retrochoroidal hemorrhage had occurred as a result of the suddenly lowered intraocular pressure upon the sclerotic vessels of the eye. The hemorrhage was of venous origin, as no pulsating flow of blood occurred.

Eugene M. Blake.

Nižetic, Zdravko. **Fixation of the transplant in keratoplastic operations.** Zeit. f. Augenh., 1936, v. 90, Dec., p. 305.

Among many important details that must be observed is the fastening of the transplant. The author disapproves of the conjunctival sutures which Friede lays over the transplant to anchor it. Instead, he favors the use of a conjunctival flap which has been turned so that the epithelial side lies in contact with the transplant and is secured by sutures through the conjunctival limbus opposite. F. Herbert Haessler.

Schwarz, J. **Investigations concerning Gurvitch's corneal radiation.** Arch. f. Augenh., 1936, v. 110, Dec., p. 216.

The author confirms Gurvitch's contention that the cornea radiates so-called mitogenic rays, sent out by cells during mitosis and consisting of short-waved rays in the ultraviolet region of the spectrum, with a wave length of 90 to 240 millimicrons. These rays cannot be photographed, but can be detected by spectroanalysis and by their biologic effect. Staphylococcus colonies on bouillon between object glasses were held for ten minutes one mm. from the cornea of a rabbit (the glass cells being kept filled with bouillon). The cells were then incubated for fourteen hours, and the number of colonies under the microscope was compared with a control. The increase in the number of colonies gave a fair index to the activity of the Gurvitch rays. R. Grunfeld.

Soudakoff, P. S. **Contribution to the knowledge of the marginal corneal ulcer.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1393-1400.

The five cases were characterized by (1) development at the periphery and remaining confined to this zone and not spreading as does ulcus serpens; (2) chronicity; and (3) tendency to recurrence. All were exogenous except one, and the pathologic process was confined to the anterior or the anterior and middle thirds of the cornea. In one exceptional case the ulcer was progressive and the end result a completely leucomatous cornea.

Lawrence G. Dunlap.

Witzeman, L. A. **A new electric corneal drill.** Arch. of Ophth., 1936, v. 16, Nov., pp. 857-858.

A chuck is substituted for the trephine on the Green corneal trephine so that dental burs can be introduced and used for the removal of foreign bodies. J. Hewitt Judd.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Cavallacci, G. **A case of congenital bilateral aniridia with lens coloboma.** Arch. di Ottal., 1936, v. 43, April, p. 121.

Such a case is described and the author discusses the etiology in detail. (Color plate.) Herman D. Scarney.

Guillery, H. **The complete picture of sympathetic inflammation in an animal experiment.** Arch. f. Augenh., 1936, v. 110, Dec., p. 174.

The author claims that he was able to produce all the essential details necessary to make the diagnosis of sympathetic ophthalmia. The uveal tissues of the traumatized eye were infiltrated with giant cells of the Langhans type as well as numerous epithelioid cells. In the nontraumatized eye the vascular layer of the choroid was infiltrated mostly with lymphocytes. Earlier the author had been able to produce the complete microscopic picture, in one case even in the nontraumatized eye, by introducing the toxins of the tubercle bacilli directly into the eyeball. But in the present experiment the complete picture was obtained by injecting the toxin into the blood stream, a procedure imitating natural conditions more closely. (For description of the technique used see Amer. Jour. Ophth., 1936, v. 19, p. 941.) R. Grunfeld.

Lodato, G. **Action of nicotine on the pupil.** Arch. di Ottal., 1936, v. 43, April, p. 146.

Experiments on frogs injected with solutions of nicotine of 0.5 and 1 percent showed that the stronger solutions produced miosis and the weaker solutions mydriasis. In some cases mydriasis was produced in one eye and miosis in the opposite eye. Unequal efficiency in the sympathetic chains may account for the anisocoria.

Herman D. Scarney.

Lindner, K. **The clinical aspect of the vitreous. 2. Serous detachment of the choroid following a leak in the eyeball.** Graefe's Arch., 1936, v. 135, p. 462. (See Section 10, Retina and vitreous.

Mamola, P. **Variation in amount of glucose in the aqueous after cervical sympathectomy.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 180.

The author reports a series of experiments upon rabbits, in which the superior cervical sympathetic ganglion was extirpated on one side. He employed the modified micromethod of Bang to determine the amount of glucose in the aqueous. Extirpation of the ganglion led to marked increase in the percentage of glucose on the operated side, this increase persisting for eight to ten days. Only a slight, early increase was observed on the opposite side. (Tables.) Eugene M. Blake.

Nuñez Llanes, F. **A case of tuberculous uveitis cured by methylic antigen.** Rev. Cubana Oto-Neuro-Oft., 1936, v. 5, July-Aug., p. 115.

The response to such treatment in a boy of twelve years is taken as indicating its use in all cases of chronic uveitis not due to lues, albuminuria, or diabetes. M. Davidson.

Simons, L. T., and Pratt, F. J. **Sympathetic ophthalmia.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 181-182.

Trowbridge, D. H., Jr. **Sympathetic ophthalmia.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 135-148.

8

GLAUCOMA AND OCULAR TENSION

Ciotola, G. **The vascular state of the glaucomatous, especially medial arterial pressure and venous pressure.** Rassegna Ital. d'Ottal., 1936. v. 5; Jan.-Feb., p. 82.

Examination of the circulatory constants of 38 cases of primary glaucoma demonstrated that in the majority there was arterial hypertension referable to maximum arterial pressure. The minimum arterial pressure was often above normal but was not observed with great frequency. The mean arterial pressure was almost always normal or subnormal. The venous pressure, as determined by Claude's method, was increased in almost all of the cases examined. This was often the only objective sign of an altered vascular state. As a control the author examined 37 patients with other nonglaucomatous eye conditions. He concludes that changes in endocular arterial pressure are more common in the latter and that there is usually an augmentation. Alterations in the vascular apparatus are factors of great importance in the pathogenesis of glaucoma and emphasize particularly the great frequency of alterations in the venous tree. (2 tables.)

Eugene M. Blake.

Contino, A. **On anterior hemorrhagic glaucoma.** Ann. di Ottal., 1936, v. 64, July, 433.

The author makes a definite distinction between the anterior hemorrhagic glaucoma and primary irritative glaucoma which is nonhemorrhagic. In the former the anterior chamber is increased in depth, with semidilatation of the pupil and congestion of the iris tissues. The treatment consists of an iridectomy after the employment of mydriatics with constrictives (contrary to usual procedure), as synechiae will otherwise occur. General treatment is more helpful in the initial stages of the malady as it may then be possible to obtain functional restoration. Even later it will relieve the pain. In old cases with pupillary synechiae complete decongestion is impossible and surgical intervention is not helpful.

Park Lewis.

Kronfeld, P. C., and Lin, C. K. **Anterior-chamber punctures, an aid in the diagnosis of glaucoma.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1324-1334.

The authors did anterior-chamber puncture as a provocative test to diagnose early or latent primary simple glaucoma. Reactive hypertony was a constant and essential symptom of eyes affected with simple glaucoma. The anterior chamber was completely emptied by transcorneal puncture with a short bevelled hypodermic needle inserted between iris and cornea. In 400 punctures traumatic cataract resulted in two cases. Most dependable reactions were elicited when the chamber was completely emptied. Tension taken every half hour showed a maximum hypertensive reaction in 2.5 hours. The reaction was always self-limited, subsiding spontaneously, and never producing acute glaucoma.

Lawrence G. Dunlap.

Ohm, Gerd. **The glaucoma problem and provocative tests. Intermittent glaucoma.** Graefe's Arch., 1936, v. 135, p. 537.

The results of hourly tonometer readings between 8 a.m. and 7 p.m. are reviewed as observed among 49 patients: 18 with primary glaucoma, 7 with secondary glaucoma, 3 with glaucoma of unstable tension, 2 with no symptoms of glaucoma except very unstable tension, 6 of "pseudoglaucoma" with no increased tension but visual-field defects characteristic of glaucoma, and 13 with definitely normal tension. The effect upon the tension was noted of drinking 500 to 1000 c.c. of tap water having an addition of raspberry syrup, of drinking 45 gm. of coffee brewed in 150 c.c. of water, of remaining for one hour in total darkness, and of wearing the tight head bandage (Leege method) for one hour. The test of drinking tap water was found to produce a greater increase of tension in four out of eight

cases whose pressure curve for the day otherwise never rose above 30 mm. of Hg. In one case this occurred after the coffee drinking test. It is therefore expedient to employ the tap water and coffee tests in all cases where application of a provocative test is required.

H. D. Lamb.

Post. W. L. **Neo-synephrine.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 170-177. (See Section 2, Therapeutics and operations.)

Santonastaso, A. **The etiopathogenesis of hydrophthalmos.** Ann. di Ottal., 1936, v. 64, June, p. 405, and July, p. 437.

After an extensive review of the bibliography the author reports in detail thirteen clinical cases of hydrophthalmos. The absence of lues in the history of the first twelve and the histologic findings in the thirteenth case demonstrated a close relationship of the disorder with other infective maladies and hydrophthalmos. The author concludes that a major element in the pathogenesis is endarteritis with endophlebitis and infiltration by paracellular elements and plasma cells. Retention of hypersecretion is an adequate explanation of the hydrophthalmos. (Two plates, 12 figures, bibliography.)

Park Lewis.

Seidel, E. **Determination of the amount of the blood plessure in the vortex veins of the human eye with normal ocular tension.** Graefe's Arch., 1936, v. 136, p. 303.

Observations were made on numerous albinotic, otherwise normal human eyes. Because the ampullae of the vortex veins in the suprachoroidea are covered by the retina and choroid, more pressure on the exterior of the eye would be necessary to stop the flow of blood in the ampulla of a vortex vein as compared with the central retinal vein. To correct for this anatomic difference, attention was directed with the ophthalmoscope to the place of exit of the ampulla of the vortex vein into the sclera. It was found that with the addition of a minimal pressure to the normal ocular tension, the flow of blood at the exit of the vortex vein into the sclera is stopped. The blood pressure at the place of exit of the choroidal veins, like that of the retinal veins, is a few millimeters over the normal intraocular tension of 20 to 25 mm. Hg.

H. D. Lamb.

9

CRYSTALLINE LENS

Bakker, A. **A method for keeping alive the lenses of adult rabbits outside of the body.** Graefe's Arch., 1936, v. 135, p. 581.

The culture medium was devised by DeHaan to provide a tissue culture for leucocytes. After injection of 500 c.c. of Ringer's solution into the peritoneal cavity of a rabbit, this fluid is entirely absorbed by next day, when another injection of 0.75 to 1 liter of Ringer's solution is made. Three hours later, the sterile fluid in the peritoneal cavity, sometimes as much as 500 c.c., is drawn off. The following day, the same procedure can be repeated. Two flasks at different levels are joined together by glass tubing with sleeves of rubber tubing. In the middle of the connecting tubing is inserted a thin disc-shaped glass chamber 1 cm. thick. In this chamber a lens from an adult rabbit, removed under sterile conditions immediately after death, can be studied under the microscope as the culture fluid flows at the rate of one drop a minute from the higher to the lower flask. In this manner, lenses could be kept alive and entirely clear for eight days. The amount of oxygen needed by a lens could be measured by means of Krogh's microgas-analysis apparatus inserted between the two flasks. The lens of rabbits seven or eight weeks old required between 3.6 and 4.6 c. mm. per hour per lens. The amount of glucose used in the metabolism of the lens was determined by allowing the lens to remain in 10 c.c. of culture fluid for eight hours. The lens used 0.07 mg. of glucose per hour.

H. D. Lamb.

Bakker, A. **Regeneration of the injured lens capsule of rabbit eyes in tis-**

sue culture. Graefe's Arch., 1936, v. 136, p. 333.

After a wound in the anterior lens capsule of the rabbit and some other animals, the opacity in the lens remains confined to the immediate vicinity of the wound. Ten days after injury of the lens capsule of a rabbit with a discission needle, the eye is enucleated and the injured lens placed in the tissue culture. At this time a thin disc of cicatricial tissue rich in cells fills in the gap formed by the wound in the lens capsule. In another ten days, or twenty days from the time of injury of the lens capsule, normal lens epithelium has developed beneath the cicatricial disc and this new-formed lens epithelium has begun to secrete a thin layer of capsule superficial to itself. The author's observations are taken to prove that the lens capsule and the cicatricial tissue are of ectodermal origin.

H. D. Lamb.

Beisbarth, Carl. **Spontaneous expulsion of cataract nucleus.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 184-186.

Bellows, J. G. **Biochemistry of the lens. 9. Influence of vitamin C and sulfhydryls on the production of galactose cataract.** Ach. of Ophth., 1936, v. 16, Nov., pp. 762-769.

The results of five sets of experiments on rats are reported to show that cataracts are produced in the albino rat by a diet rich in galactose. An excessive amount of sulfhydryls or vitamin C delays the onset of cataract in rats receiving galactose. The sulfhydryl content (cystine) is decreased by the presence of galactose, and as a result of this the internal oxidative system of the lens reaches a stage where it is insufficient and death of the tissue ensues with resulting opacification.

J. Hewitt Judd.

Bellows, J., and Rosner, L. **Biochemistry of the lens. 10. Preparation of glutathione from the crystalline lens.** Arch. of Ophth., 1936, v. 16, Dec., pp. 1001-1003.

The authors describe the technique by which glutathione was extracted from the crystalline lens. The slight variation from the theoretical values is explained by the fact that no recrystallization was attempted, owing to the small quantity obtained.

J. Hewitt Judd.

Bettman, J. W., and Barkan, H. **Trichloracetic acid in the treatment of iris prolapse.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 131-134.

Glick, D., and Biskind, G. R. **Studies in histochemistry. 10. Distribution of vitamin C in the lens of the eye.** Arch. of Ophth., 1936, v. 16, Dec., pp. 990-995.

Investigations of the lens were made to determine the quantitative concentration of vitamin C from the periphery of the lens to its center by means of the microtitration apparatus of Linderstrom-Lang and Holter. These show a slight decrease in concentration in the nucleus as compared with the rest of the lens. J. Hewitt Judd.

Knapp, Arnold. **Complications of the forceps-intracapsular operation for cataract; based on an analysis of five hundred successive cases.** Arch of Ophth., 1936, v. 16, Nov., pp. 770-775; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 162.

Complications are considered in two groups: those occurring during the time of operation and those during a healing and later stage The only complication in the first group considered is prolapse of vitreous. The definite improvement with each succeeding hundred cases shows that better anesthesia and greater experience much reduce the frequency of this complication. The second group included (1) a severe and definite form of iridocyclitis due to traction on the ciliary body; (2) glaucoma, which is less frequent with the intracapsular than with the extracapsular operation; and detachment, which occurred in only six cases and is therefore probably not more frequent after this type of operation.

J. Hewitt Judd.

Lijo Pavia, J. **Two models of hand-operated vacuum extractors of cat-**

aract. Rev. Oto-Neuro-Oft., 1936, v. 11, Nov., p. 310.

Two new models of vacuum fixation of the lens, first suggested by Hulen, and recently developed by Saint Martin and by Rochon-Duvigneaud and Nogues, are described and illustrated. The second model is made of aluminum and weighs only 30 gm. In spite, however, of using a larger cylinder to increase pulling power, only 35 gm. of pull is achieved. But Arruga's model of which the author learned afterward, achieves a pull of 55 gm. The hand-operated vacuum extractor offers the possibility of applying the essential principle of all intracapsular methods, namely: to impart a rocking movement to the lens. M. Davidson.

Müller, H. K. **The senile change of glycolysis in the lens.** Arch. f. Augenh., 1936, v. 110, Dec., p. 206.

The author examined the partial derivatives obtained during the glycolytic action of senile lenses, and found glycolysis altered in them. Watery extract of a senile lens has lost much of its ability to change hexosediphosphate into triose, and also its ability to form phosphoric-acid ester. The action of its enzyme zymohexase, which mediates the equilibrium reaction between hexosediphosphoric acid and triose-phosphoric acid, is similarly depressed by age. The activity of phosphatase, however, seems uninfluenced by age. R. Grunfeld.

Riad, M. **A case of congenital axial cataract with deposit of cholesterin crystals.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 125.

The patient, a woman, aged forty years, had had defective vision since early childhood, with gradual failure of vision during recent years. Examination revealed congenital cataracts with fine iridescent crystals, which had the appearance of rectangular glass fragments. No clinical evidence of hypoparathyroidism, hypothyroidism, or myotonia atrophica was found.
Edna M. Reynolds.

Sala, G. **Endocrine cataract.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 169.

After general discussion of the development of lenticular opacities in the presence of disturbances of the ductless glands, Sala relates three cases personally observed. The first concerned a fifteen-year-old girl who after menstruating very frequently and profusely for three years had malnutrition and underweight. The second patient was an unmarried woman of thirty years who had long suffered from severe ovarian pain, ultimately requiring surgical treatment. The third patient, an unmarried woman of 27 years, had a right-sided swelling of the thyroid, with increased metabolic rate. In the first and third cases the lenticular change involved the posterior cortical layers, and in the second the anterior cortex. All three were of the sunburst type. (3 figures.) Eugene M. Blake.

Salit, P. W. **Total lipids of human cataractous and sclerosed lenses.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 157-165.

Wieczorek, Anton. **Surgery of senile cataract in Poland.** Klinika Oczna, 1936, v. 14, pt. 5, p. 599.

A survey of the procedures practiced in Poland, obtained through a questionnaire, and based on 13,570 extractions performed between 1930 and 1934. The survey shows the usual wide variations in technique among ophthalmic surgeons. Ray K. Daily.

Wright, R. E. **Lectures on cataract.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 1-12. **2. Difficulties at the time of cataract operation.** The same, Feb., pp. 119-131.

10

RETINA AND VITREOUS

Bonnet, P., Paufique, L., and Sarrazin, L. **Recurring vitreoretinal hemorrhages in young subjects.** Arch. d'Opht., 1936, v. 53, Dec., p. 849.

The authors review the literature and report one case, that of an ex-soldier aged 23 years, who in 1934 had artificial pneumothorax for pulmonary tuberculosis. One year later bilateral ocular periphlebitis was discovered. The spu-

tum was positive. In spite of the fairly conclusive evidence of tuberculous etiology in this case, the authors believe that other factors must also be considered, such as modifications of blood chemistry, circulatory disease, focal infections, endocrine disturbances, avitaminosis, and syphilis. (Colored plates, bibliography.) Derrick Vail.

Bunge, E. **The course of dark adaptation in oxygen deficiency.** Arch. f. Augenh., 1936, v. 110, Dec., p. 189.

The author investigated the effect of air deficient in oxygen on dark adaptation under normal atmospheric pressure. The subjects inhaled in regular rhythm an air containing only ten per cent oxygen, about 10 liters per minute. The adaptation curve was distinctly lowered, that is the threshold was raised to a value three times higher than normal. It was also noted that formation and regeneration of the visual purple was not influenced by anoxemia. We must assume, therefore, that the cause of altered adaptation was disturbance of metabolism of the nervous tissues along the visual path. Disturbance of the higher psychic centers, such as disturbance of consciousness, does not have to be taken into consideration, since the persons examined seemed alert and always gave prompt replies. R. Grunfeld.

Giovanni, Bruno. **Concerning cystic degeneration of the retina at the ora serrata.** Arch. f. Augenh., 1936, v. 110, Dec., p. 183.

The author maintains that so-called cystic degeneration of the retina at the ora serrata is not a normal senile change, but one due to chronic edema caused by altered permeability of the capillaries at the retinal margin. The retina in places imbibes fluid, fluid-filled cysts and lacunae form, and the fibers and cells adjacent to them degenerate after a prolongation of their nuclei. The retinal structure is thus altered in all parts, especially in the outer plexiform layer. These changes are not found in persons younger than 25 years, but their frequency does not run parallel with increase in age. R. Grunfeld.

Jäger, Alfred. **Reflex streaks upon the retinal vessels.** Arch. f. Augenh., 1936, v. 110, Dec., p. 138.

On the retinal vessels two kinds of reflex streaks are discernible. A narrow, bright, brilliant, bluish-white streak represents the reflex from the anterior vessel wall and mostly from the internal limiting membrane. It is often missing in places where the vessel bends. It is present on arteries as well as on veins. The second kind of reflex is a broad, bright but not brilliant, yellowish-red streak. It is due to light reflected from the retina. The light has twice to pass the vessel wall and the center of the circulating blood column. At the center the light penetrates easily, because there the blood corpuscles, while the blood is circulating, arrange themselves parallel with the vessel wall, whereas at the margins the light falls upon the edges of the blood corpuscles, so that the light is dispersed and the margin appears dark. The two kinds of streak can be differentiated by moving the light source. The first streak follows the light source, the second does not. R. Grunfeld.

Jameson, P. C. **Operative treatment of detached retina; principles observed by six individual operators.** Arch. of Ophth., 1936, v. 16, Dec., pp. 996-1000.

This article consists of a résumé of the most important points for a successful operation, given by each operator. The communications were from Marshall, Knapp, Peter, Schoenberg, Wheeler, and Walker.

J. Hewitt Judd.

Koyanagi, Y. **The pathologic anatomy and pathogenesis of the crossing phenomenon of the retinal blood vessels in high tension.** Graefe's Arch., 1936, v. 135, p. 526.

The first essential change is pathologic constriction of the lumen of the retinal artery. This may be due either to angiospastic contraction or to sclerotic thickening of the artery. Obviously it is not necessary that the vein at the place of crossing shall always be easy to obstruct. If both vessels are directly bound together, there occurs Gunn's de-

pression or constriction which can occasionally cause thrombosis and retinal hemorrhage. H. D. Lamb.

Lindner, K. **The clinical aspect of the vitreous. 2. Serous detachment of the choroid following a leak in the eyeball.** Graefe's Ach., 1936, v. 135, p. 462.

When the eyeball of a cadaver is punctured through the cornea, the anterior chamber is restored by fluid coming from the vitreous. When the anterior chamber is emptied, the lens moves forward close to the cornea because of the active pressure in the vitreous. The same thing happens in the living eye when the anterior chamber is punctured the first time. However, when it is quickly punctured a second time, the eyeball is so soft and the suspensory ligament of the lens so relaxed, that the lens no longer presses upon the vitreous. Consequently the larger part of the new aqueous arises from the ciliary body. A leaking eye with detachment of the choroid has no intraocular tension, therefore no pressure can be exerted by the lens upon the vitreous so as to cause the latter to lose water. Yet in these cases it is found that the vitreous has contracted to half its normal volume and the anterior chamber has deepened. The cause for this loss of fluid must rest upon an unknown chemicophysical basis leading to a drawing inward of the retina and choroid. Absence of intraocular tension is not sufficient to produce an extensive transudate under the choroid and is not the cause of shrinking of the vitreous. The giving off of fluid and shrinking of the vitreous must be due to the effect upon the latter of the secondary aqueous. Although as mentioned in the first paper this contraction of the vitreous is reversible, nevertheless the vitreous does not return to its primary full normal volume. Detachment of the vitreous is rare after loss of vitreous.

In rabbit eyes with choroidal detachment after fistula in the vitreous, the vitreous becomes extensively fluid because the new-formed aqueous trickling through the vitreous toward the fistulous opening has a digestive action upon the vitreous network by reason of its increased content of serum albumen and of digestive ferments. Detachments of the choroid occur almost exclusively in elderly patients, because in the young the vitreous when it contracts easily separates itself from the retina and optic nerve. (Numerous other details are discussed.)

H. D. Lamb.

Perera, C. A. **Bilateral cyst of the vitreous.** Arch. of Ophth., 1936, v. 16, Dec., pp. 1015-1017.

A man aged 55 years presented freely floating, yellowish-gray cysts behind the lens in each eye. These were associated with myopia and pigmentary degeneration of the retina. This suggests a congenital degenerative etiology.

J. Hewitt Judd.

Pieck, C. F. M. **A case of neurinoma retinae.** Graefe's Arch., 1936, v. 135, p. 451.

From a 75-year-old, otherwise healthy woman, a totally blind eye with retinal detachment was removed because of pain from increased intraocular tension. The structure of the retina had been destroyed through the presence of a neoplasm and many large and small hemorrhages in all the retinal layers. The tumor cells stained well only close to the blood vessels. Some of the tumor cells resembled epithelial cells with a large amount of pale-staining cytoplasm and a usually eccentric much darker-staining nucleus. Between the latter cells were found smaller, round or angular, much darker-staining cells with almost no cytoplasm. Both of these types of cell had many mitotic figures. With stains for neuroglial cells, glial cells and neurofibrillae were observed in many places in the tumor. The vitreous membrane of the choroid was ruptured by the growth only near the ora serrata. The author compares the structure of this retinal growth with that of several other unusual primary tumors of the retina in the literature; and he concludes that the present one is unique. It owed its genesis to a disturbance in the early embryonic development of those nervous elements which normally form the ganglion cells,

glial cells, and nerve-fiber cells of the retina. H. D. Lamb.

Rinaldi, S., and Arslan, K. **Exudative retinitis secondary to hyperostotic sphenoidal sinusitis.** Boll. d'Ocul., 1936, v. 15, Oct., pp. 1035-1050.

A woman of 44 years so affected for seven years developed left exudative retinitis. The exudation, irregularly oval and greyish-white, extended in its long axis from the nasal side of the disc to the macular region in the lower half of the fundus. Endonasal treatment and opening of the posterior ethmoidal cells were followed by recovery of the retinal inflammation, cessation of the fever, and improvement of nasal symptomatology. The vision of this eye became normal, but the fundus showed slight pallor of the disc, small pigment changes in the region of the macula, and obliteration of the lower retinal artery. (Bibliography, six figures.)
M. Lombardo.

Rizzi, C. **Senile macular degeneration of the retina.** Arch. di Ottal., 1936, v. 43, April, p. 149.

The author discusses the etiology and describes two cases. The first case was one of a form of senile bilateral exudative macular retinitis with characteristics of circinate retinitis, and the second case was one of senile exudative macular retinitis (senile disciform degeneration of the macula). (Bibliography.) Herman D. Scarney.

Sallmann, L. **The anatomy of posterior detachment of the vitreous.** Graefe's Arch., 1936, v. 135, p. 593.

Since preparation of eyeballs with the customary fixatives and dehydration with alcohol may be accompanied by detachment of the vitreous in normal eyes, such method is unsuitable for this study. Among twelve freshly enucleated pathologic human eyes, dissected and studied microscopically without employment of a fixative, two cases of septic edophthalmitis definitely showed posterior detachment of the vitreous. In a case of tuberculous iridocyclitis and scleritis and one of high myopia and acute hypotony, detachment of the vitreous was not determined until the eye was embedded and examined histologically. The frequency of posterior detachment of the vitreous in apparently normal eyes was determined in forty eyes removed at autopsy from individuals of all ages. In only three eyes from women 64, 65, and 66 years old did the well recognized difficulty of differentiating anatomically between liquefaction and detachment of the vitreous make the presence of vitreous detachment appear possible. Using Redslob's procedure (immersion of the eyeball for several hours in fifty-percent pyridin solution, stripping the coverings of the vitreous with the exception of the lens and the anterior part of the pars plana of the ciliary body, then further treatment with the pyridin solution followed by immersion in distilled water to render gray the outermost layer of the vitreous), in only one of three doubtful cases was vitreous detachment diagnosed. H. D. Lamb.

Sallmann, L. **Observations with slitlamp of the anterior limiting layer of the vitreous after removal of lens in capsule.** Graefe's Arch., 1936, v. 135, p. 602.

Examination with the slitlamp of aphakic eyes after intracapsular extraction with uncomplicated vitreous hernia reveals in some cases in the presence of a choroidal detachment, more or less retraction of the anterior surface of the vitreous at the site of the vitreous hernia previously present. The limiting layer of the vitreous, when no posterior synechiae are present, is thus definitely located behind the level of the pupil.
H. D. Lamb.

Sanctis, E. de. **Modifications of corneal curvature following intervention for retinal detachment with diathermy coagulation.** Arch. di Ottal., 1936, v. 43, March, p. 111.

The Javal-Schiötz ophthalmometer was used for the measurement of corneal curvatures. Ten cases were studied and the readings made before and after operative intervention. In the majority of cases there was an increase in corneal curvature in one or both meridians.

Readings were continued for from one to three months after operation.

Herman D. Scarney.

Selinger, Elias. **Retinal angiospasm in toxemia of pregnancy and hypertension.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 56-59.

Spinelli, Francesco. **The retinal angiotonometer of Spinelli.** Soc. Oft. Ital., 1934. Reprint in Saggi di Oft., 1934-1936, v. 8.

The writer points out several defects of Bailliart's tonometer, such as difficulty in learning to use the instrument, since an error of one mm. makes a notable difference in the reading. Furthermore, the spiral spring loses its tension in time, and changes in temperature affect the readings. Spinelli has constructed an instrument of aluminum in which the spring is of the cross-bow type and is very durable. Either one or both arcs of the spring may be used, thus making it very sensitive. Two scales on the face of the instrument correspond to the single or double spring used. (4 figures.) Eugene M. Blake.

Spinelli, Francesco. **Treatment of retinal detachment with diathermic coagulation.** Boll. d'Ocul., 1936, v. 15, Oct., pp. 1051-1093.

The writer uses his micrometer with the Gullstrand ophthalmoscope for localization of the retinal tear. He gives the history of seventeen cases of retinal detachment treated with the flat or the perforating method of diathermy, which he performs soon after an evacuating puncture. Eleven cases (64.70 percent) showed permanent recovery. The writer thinks this method best for the treatment of the detachment. He agrees with Weve, Coppez, di Marzio and others that for success of the operation the retinal tear must be exactly localized. (Bibliography, 18 figures.)

M. Lombardo.

Tan, Vicente. **Formation of new vessels in the vitreous.** Arch. of Ophth., 1936, v. 16, Dec., pp. 1004-1014.

Three cases are reported from the Meller clinic illustrating the formation of new vessels in the vitreous. Since these always regress after resorption of the hemorrhage or exudate. it is concluded that their function is only reparatory. They usually are associated with inflammatory processes of a syphilitic or tuberculous nature. (Drawings.)

J. Hewitt Judd.

Thomson, M., and Cave, H. A. **Experimental detachment of the retina; treatment with subretinal injections of blood plasma.** Arch. of Ophth., 1936, v. 16, Dec., pp. 964-966.

Under direct observation with a specially devised hydrophthalmoscope, the authors were able to detach the neuroepithelial layer of the retina with physiologic salt solution. Blood plasma was injected after withdrawal of part of the saline. Sections of eyes treated in this manner and enucleated after two to four weeks showed minute strands of fibrin between the pigment layer and the neuroepithelial layer. Saline solution alone does not cause strands of fibrin to form. J. Hewitt Judd.

Tristaino, L. **A case of Jensen's retinochoroiditis juxtapapillaris.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 194.

A man of 28 years presented himself because of loss of vision of four days duration in the right eye. Fundus examination disclosed a picture of acute optic neuritis, which changed in a few days to that of Jensen's disease. The localized patch of chorioretinitis at the nasal border of the disc was yellowish-white in color and of the size of the nerve-head. The field of vision showed a fan-shaped scotoma in the temporal sector, with the apex at the blind spot. Physical examination was negative except for a hemorrhagic seminal vesiculitis, probably of tuberculous origin. A good review of the literature of this unusual fundus picture is presented. (2 figures.) Eugene M. Blake.

Weve, H. J. M., and Fischer, F. P. **The enzyme content of the retroretinal fluid in retinal detachment.** Arch. f. Augenh., 1936, v. 110, Dec., p. 198.

The retroretinal fluid of 58 cases with detached retina was examined for its amylase content. It was found that only

in the fluids, twelve in number, whose specific gravity was above 1,012 was amylase present. Further studies revealed that normally among the tissues of the eye only the retina contained amylase, in the form of desmoamylase. The latter is an amylase chemically bound to protoplasm and set free only by a proteinase or by autolysis. The amylase found in the retroretinal fluid must, therefore, have taken its origin from a local destruction of the retina. This destruction must have preceded the detachment, since the authors never found amylase in a fluid during subsequent examinations when once the fluid had been found devoid of amylase. The increase in specific gravity is not due to an increased albumin content, for no albumin or only a small amount could be detected in the retroretinal fluid; but it is due to its enzyme content. An enzyme according to Willstädter is an active chemical group bound to a colloid carrier, to which must be attributed the increase in specific weight.

R. Grunfeld.

Yonechi, S. **Experimental observations on the effect of nephrotoxin on the eye.** Communication 7. **The pathologic secretory process of the retinal pigment epithelium.** Graefe's Arch., 1936, v. 136, p. 312.

A filtered suspension of ground-up adult rabbits' kidneys in normal saline solution was injected, altogether 21 times either subcutaneously or intraperitoneally, into four goats at intervals of between five and ten days. The concentration of the suspension was about twenty percent and the amount injected each time varied between 30 and 100 c.c. A diffuse glomerulonephritis of varying intensity was produced in the goats. Blood containing nephrotoxin was drawn off from the jugular vein of the goat and allowed to stand at room temperature for 24 hours, and the clear antiserum at the top drawn off and kept at 56°C. for 30 minutes so as to render inactive its primary toxicity. In 22 out of 41 adult rabbits injected in the carotid artery with the prepared goat's serum, appreciable changes occurred in the fundus of the injected side. Six out of 20 rabbits injected in the vein of the ear gave a positive result. The affected eye presented a more or less pronounced proptosis accompanied by chemosis of moderate degree. With the latter, irregular grayish-white spotted and streaked opacities occupied preferably the lower half of the fundus. Anatomically, it was found that the retinal pigment epithelium was primarily affected by the injurious action of the nephrotoxin. The pigment epithelium reacted by secreting first a thin serous fluid which gradually became thicker in albumen. These fluids invaded the external layers of the retina and were the causes of the spotted and streaked opacities in the fundus. No specific relation was found to exist between the kidneys and the retinal tissue proper. Instead, the retinal pigment epithelium held a very close relation to the tubular epithelium of the kidneys since both could react to the injurious action of the highly potent nephrotoxin with similar changes. H. D. Lamb.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Carroll, F. D. **"Alcohol" amblyopia, pellagra, polyneuritis.** Arch. of Ophth., 1936, v. 16, Dec., pp. 919-926.

The author reviews the literature and reports ten cases to show that the alcoholic type of polyneuritis and the alcoholic type of pellagra are deficiency diseases associated with vitamin-B deficiency. (Photographs.)

J. Hewitt Judd.

Chen. P., and Ling, W. P. **Further observations on retrobulbar neuritis in the Chinese.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1373-1380.

In two years the authors saw 180 cases of retrobulbar neuritis in soldiers, all under the age of 30 years. Rapid visual fatigue was the chief complaint and most cases were bilateral. No case ended in blindness. Multiple sclerosis, considered in the occident the most common cause of retrobulbar neuritis, is practically unknown in China.

Lawrence G. Dunlap.

Cordes, F. C. **Retrobulbar injections of atropine in arteriosclerotic atrophy.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 53-55; also Trans. Pacific Coast Oto-Ophth. Soc., 1936, 24th annual meeting.

Ekdawi, A. Y. **Quinine amblyopia.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 129.

Blindness and deafness followed an attempt at suicide by a girl aged thirteen years, who swallowed 250 grains of quinine. Intramuscular injections of angioxyl, continued over a period of two months, restored vision to 6/6 in each eye. The author reviews the differential diagnosis of quinine amblyopia and the pharmacology of quinine.

Edna M. Reynolds.

Fine, Max, and Barkan, Hans. **Prevention of ocular complications in tryparsamide therapy.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 45-52.

King, Clarence. **Chronic traumatic subdural hematoma as a cause of choked disc.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 149-163; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 217.

Leimgruber, M. **Research in the heredity of drusen of the optic disc.** Graefe's Arch., 1936, v. 136, p. 364.

To the five cases of familial presence of drusen of the disc described in the literature, five new cases are added. Of 41 members of these five families who could be examined, 23 presented drusen in the disc. The author's observations indicated strongly a dominant manner of inheritance for this pathologic condition.

H. D. Lamb.

Lin, C. K. **Retrobulbar neuritis among the Chinese.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1345-1372.

Lin reports 43 cases of retrobulbar neuritis seen in the past eleven years with the three cardinal signs of impaired vision, central scotoma, and little or no fundus change. The age incidence was 14 to 48 years, with 65 percent of the cases falling in the age period of 15 to 29 years. The affection was bilateral in 94 percent of the cases. Visual acuity averaged 0.1; and 39 eyes became normal, 27 were improved, 35 remained stationary, and 2 got worse. Out of 13 eyes with enlarged blind spots only 7 showed sinusitis. Of the peripheral visual fields 55 percent were normal for both form and colors. As etiologic factors multiple sclerosis, sinus disease, alcohol and tobacco, syphilis, focal infection, drugs, and so on, were considered but in 72 percent the etiology remained undetermined. The treatments giving best results were KI, fever therapy induced by milk or thyroid vaccine, sweat baths, and vitamins.

Lawrence G. Dunlap.

Pfingst, A. O. **Anomalous ophthalmic artery with ocular symptoms.** Arch. of Ophth., 1936, v. 16, Nov., pp. 829-838; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 71.

The author reviews the literature and reports the case of a girl aged nine years, in whom limitation of motion and proptosis of one eye indicated a lesion near the optic foramen. This region was exposed by craniotomy and an aneurism of the ophthalmic artery discovered. The roof of the optic foramen was removed and the dura incised the whole length of the optic nerve to afford a decompression. The child recovered with recession of the proptosis but only partial recovery in vision, due to atrophy of the nerve.

J. Hewitt Judd.

Riddell, W. J. B. **The early stages of tobacco amblyopia.** Glasgow Med. Jour., 1936, v. 125, June, p. 268.

Tobacco amblyopia was observed in a one-eyed patient 37 years old. The condition lasted two years before complete recovery. The patient was not able to distinguish the color charts, although the fields were almost normal.

Theodore M. Shapira.

Testa, U. **Oxycephaly and alterations of the optic foramina.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 258.

Testa describes a case of oxycephaly in a young man with blindness in one eye only. From radiographic study of

the skull he concludes that the optic atrophy may have been due to true inflammation of the nerve, or to compression of the nerve by the narrowed optic foramen or the knee of the carotid. The latter was possible because of a defect in the optic canal which allowed the artery to come into contact with the nerve. Unilateral optic atrophy in oxycephaly may raise a medicolegal question, as in this case, where injury to the sclera by a chip of cast iron preceded loss of vision. (4 figures.)

Eugene M. Blake.

12

VISUAL TRACTS AND CENTERS

Filippi-Gabardi, E. **The diagnosis of lesions of the chiasm due to changes in the internal carotid artery.** Bolletino d. Scienze Mediche, 1934, v. 56, no. 4. Reprint in Saggi di Oft., 1934-1936, v. 8.

Two cases presented ocular disturbances traceable to calcification of the internal carotid artery. The author carefully outlines the differential diagnosis between this condition and luetic optic atrophy, multiple sclerosis, primary optic atrophy, toxic optic neuritis and hypophyseal tumors. The final diagnosis is made on the basis of roentgenograms which showed the calcified arteries. (2 figures.) Eugene M. Blake.

Magoun, H. W., Atlas, D., Hare W. K., and Ranson, S. W. **The afferent path of the pupillary light reflex in the monkey.** Brain, 1936, v. 59, June, p. 234.

Investigation of the afferent path of the pupillary light reflex in the monkey by electrical stimulation of the interior of the brain stem indicates that the light-reflex fibers traverse the portion of the optic tract which runs medially to the lateral geniculate body and passes caudad along the lateral and dorsal aspect of the medial geniculate body, to reach the brachium of the superior colliculus. The afferent path of the light reflex in the monkey has thus been found to be essentially the same as that recently established for the cat.

Theodore M. Shapira.

Marzio, Q. Di, Cavina, C., and De Nigris, G. **Optico-chiasmal arachnoiditis.** Riv. Oto-Neuro-Oft., 1936, v. 13, July-Aug., pp. 291-328.

Seven patients, four of them male, whose age varied from ten to 53 years, were operated on by the transfrontal, intradural route for general and optico-chiasmal symptoms among which predominated a peculiar peripapillary edema or total or partial upper or lower atrophy of the optic nerves and corresponding defects of central vision and visual fields. An arachnoid structure was found enveloping one or both optic nerves and spreading among the surrounding parts. This was removed. In one case an arachnoid cyst was found at the anterior angle of the chiasm. Moderate but permanent improvement of vision and visual fields followed the operation except in one case which at examination had shown marked atrophy of the optic nerves. (Bibliography, 21 figures.) M. Lombardo.

Nielsen, J. M., and Von Hagen, K. O. **Three cases of mind blindness.** Jour. Nervous and Mental Dis., 1936, v. 84, Oct., p. 386.

The authors report three cases of complete mind blindness. The first was due to an organic lesion confirmed by autopsy; a vascular affair affecting the occipital lobe. The second was due to an encephalitis with softening, following poliomyelitis. The patient recovered from the poliomyelitis but not from the agnosia. The third was due to drugs (allonal and bromides) stopping of which resulted in complete recovery.

Theodore M. Shapira.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month

Deaths

Dr. Francisco Maria y Hernandez Fernandez, Miami, Fla., died February 14, 1937, aged 50 years.

Dr. Reginald Copeland Plummer, Seattle, Wash., died December 26, 1936, aged 55 years.

Dr. Arthur George Bennett, Buffalo, N.Y., died December 28, 1936, aged 75 years.

Dr. Ward Andrew Holden, New York, died January 24, 1937, aged 70 years.

Dr. John Loring Johnston, Bangor, Me., died January 14, 1937, aged 48 years.

Dr. Marshall Morgan Cloud, Los Angeles, died December 3, 1936, aged 68 years.

Dr. Fred Gershom Fielding, Glens Falls, N.Y. died January 9, 1937, aged 70 years.

Dr. Frank Yuba Gilbert, Portland, Me., died January 18, 1937, aged 58 years.

Dr. Samuel Kirkpatrick, Selma, Ala., died January 6, 1937, aged 71 years.

Dr. Louis David Green, San Francisco, Calif., died January 14, 1937, aged 54 years.

Miscellaneous

The American Board of Ophthalmology will conduct an examination in Philadelphia, June 7, 1937, and in Chicago, October 9, 1937. All applications and case reports, in duplicate, must be filed at least **sixty days** before the date of examination. John Green, M.D., Secretary, 3720 Washington Blvd., Saint Louis, Mo.

The following colleges and universities will offer courses of training for teachers and supervisors of sight-saving classes during the summer sessions of 1937. The courses are given in the order of the dates of opening.

Elementary courses

Western Reserve University, Cleveland, Ohio, June 21st to July 30th; 8:30 to 12:30 daily, clinic hours to be arranged. Credit, 6 points, graduate or undergraduate work. Director of course, Olive S. Peck, Supervisor, Braille and Sight-Saving Classes, Board of Education, Cleveland, Ohio.

Wayne University, Detroit, Michigan, June 29th to August 6th. Registration week of June 21st; 8:00 to 11:00 daily, clinic hours to be arranged. Credit, 6 points, graduate or undergraduate work. Director of course, Mrs. Gladys Dunlop Matlock, Detroit, Michigan. Information may be obtained from John J. Lee, Associate Professor of Special Education, College of Education, Wayne University.

Teachers College, Columbia University, New York, July 12th to August 20th. Registration July 8th, 9th, 10th. Sight-Saving Classes, 8:30 to 12:30 daily. Credit, 6 points, graduate or undergraduate work. Mary R. Lewis and specialists. Application should be made well in advance to Associate General Adviser, Dr. Hugh Grant Rowell, Teachers College, Columbia University.

Courses for advanced students

Western Reserve University, Cleveland, Ohio, June 28th to July 31st, 8:30 to 12:30 daily, including Saturday, clinic hours to be arranged. Credit, 6 points, graduate or undergraduate work. Director of course, Mrs. Winifred Hathaway, Associate Director, National Society for the Prevention of Blindness, 50 West 50th Street, New York. Prerequisite: Elementary course in sight-saving class work at an accredited university or equivalent. Registration may be made by mail and should be in the hands of the registrar not later than June 1st; the number of students will be limited.

Teachers College, Columbia University, New York, July 12th to August 20th. Registration July 8th, 9th, 10th. The Activity Program in Sight-Saving Classes, 9:30 daily. Credit, 2 points. Mary R. Lewis. Application should be made well in advance to Associate General Adviser, Dr. Hugh Grant Rowell, Teachers College, Columbia University.

The Washington University School of Medicine is offering a one-week's postgraduate course in ophthalmology, from May 3d to 8th. The subjects considered will be as follows: anatomy, histology, pathology, and bacteriology; treatment, diagnostic clinics, surgery, surgical clinics, slitlamp microscopy, glaucoma, orthoptics, and refinements in refraction.

Among those participating in the course will be the following guests: Drs. Vilray P. Blair, Ernest Sachs, and Louis Julianelle; and the following staff members: Drs. Shahan, Wiener, Hardy, Woodruff, M. H. Post, Schwartz, Jacobs, Alvis, Beisbarth, James, Hildreth, Lange, Meinberg, and L. T. Post.

Application should be made to the Registrar of the Washington University School of Medicine, Kingshighway and Scott Avenues, St. Louis, Mo. The fee for the course will be $50.

The George Washington University School of Medicine offers a week's course in ophthal-

mology from May 31st to June 6th. For details consult the advertising section.

Societies

Announcement is made by the American Academy of Ophthalmology and Otolaryngology of a change in the 1937 convention site to Chicago, October 10 to 15, 1937, with headquarters at the Palmer House.

There will be a joint meeting of the Washington, D.C., Ophthalmological Society and the members of the postgraduate course in ophthalmology of the George Washington University School of Medicine on May 31st in the auditorium of the District of Columbia Medical Society. A symposium on cataract will be the program for the evening, with Drs. Conrad Berens, Clyde A. Clapp, and Edmund B. Spaeth as the guest speakers.

The Eye Section of the Philadelphia County Medical Society presented the following program on March 4, 1937: Dr. Henry Irwin, Clinical case presentation from Wills Hospital; Dr. Howard Rome, Albinism from the standpoint of pigment defects, discussed by Dr. Perce DeLong. Dr. Jacob B. Feldman, Further studies in dark adaptation as a clinical test, discussed by Dr. Edmund B. Spaeth.

The Los Angeles Society of Ophthalmology and Otolaryngology elected the following officers for the year 1937: President, Dr. Isaac H. Jones; Vice-President, Dr. Frank A. Edwards; Secretary-Treasurer, Dr. John P. Lordan; Councilor, Dr. Walter R. Crane; Committee man, Dr. Orrie E. Ghrist. The Society meets at 6:30 on the fourth Monday of each month, from September to May inclusive, at the Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd.

Personals

During the Mardi Gras season in New Orleans, Dr. John O. McReynolds presented an address before the New Orleans Eye, Ear, Nose, and Throat Club on the subject "Various ophthalmic operations," with moving picture illustrations. This meeting was attended by representatives of the Louisiana State University, Tulane University, and the New Orleans Eye, Ear, Nose, and Throat Hospital.

Dr. Thomas Dyer Allen, Dr. Katherine Howe Chapman, and Dr. Walter Gabe Ackerman, formerly associated with Dr. William Hamlin Wilder (deceased), announce the removal of offices from suite 1417 to suite 1105, Peoples Gas Building, 122 South Michigan Avenue, Chicago.

One Source–
One Quality

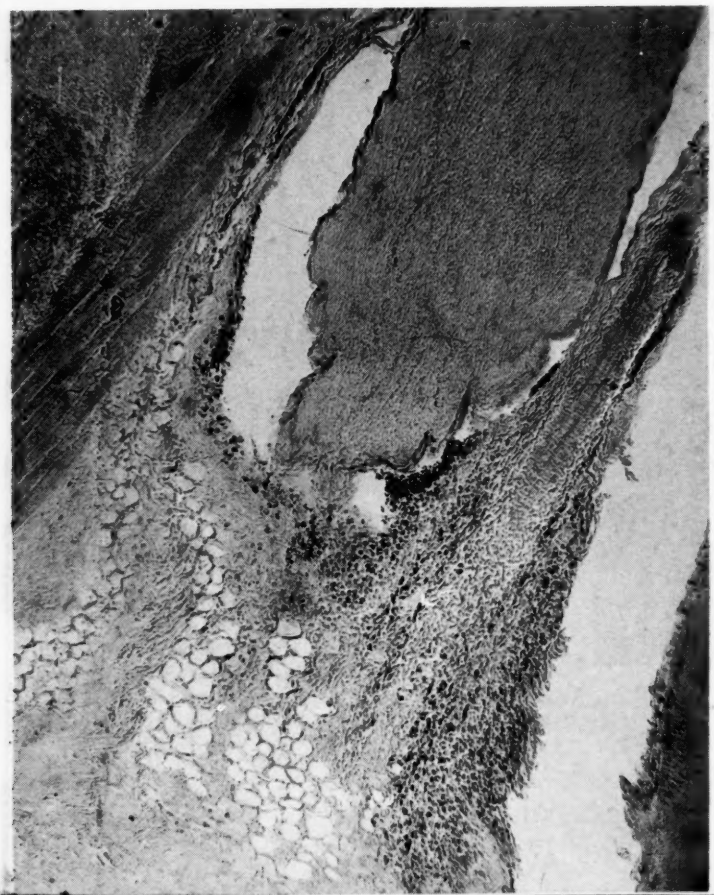
There is only one source of Soft-Lite Glass—Bausch and Lomb. That great factory makes every ounce of Soft-Lite glass, exclusively for the Soft-Lite Lens Company, Inc.

There is only one quality of Soft-Lite Lenses—the unquestioned one characteristic of products made by Bausch & Lomb.

That's two paragraphs of a story of soaring sales. The rest of the story is written this way—

"CONSUMER SATISFACTION
BEYOND QUESTION"

Soft-Lite Lenses



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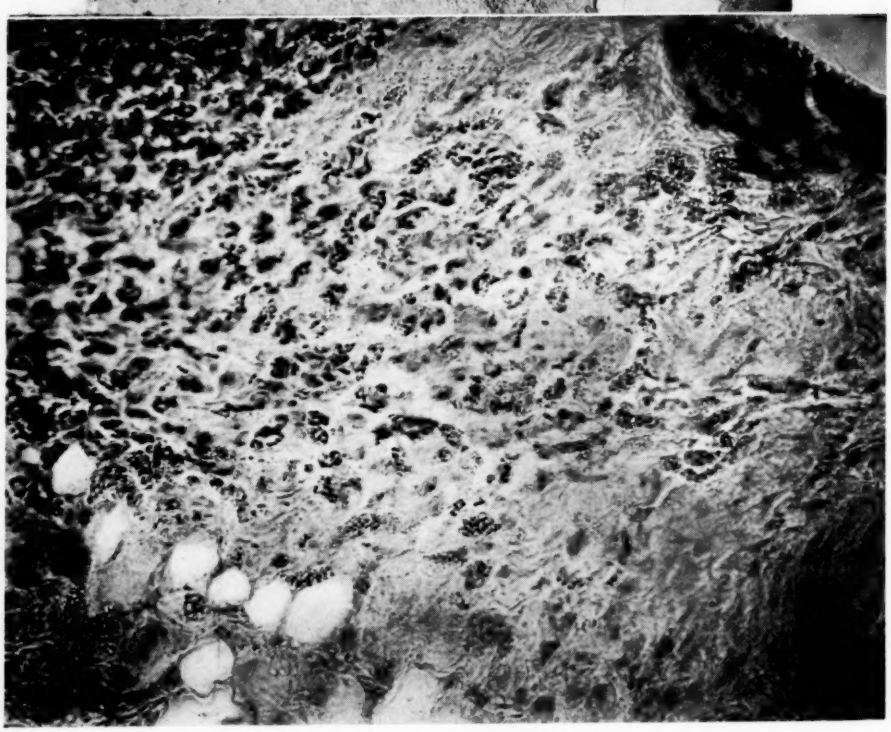

FIG. 4